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INSTALLATION RESTORATION PROGRAM

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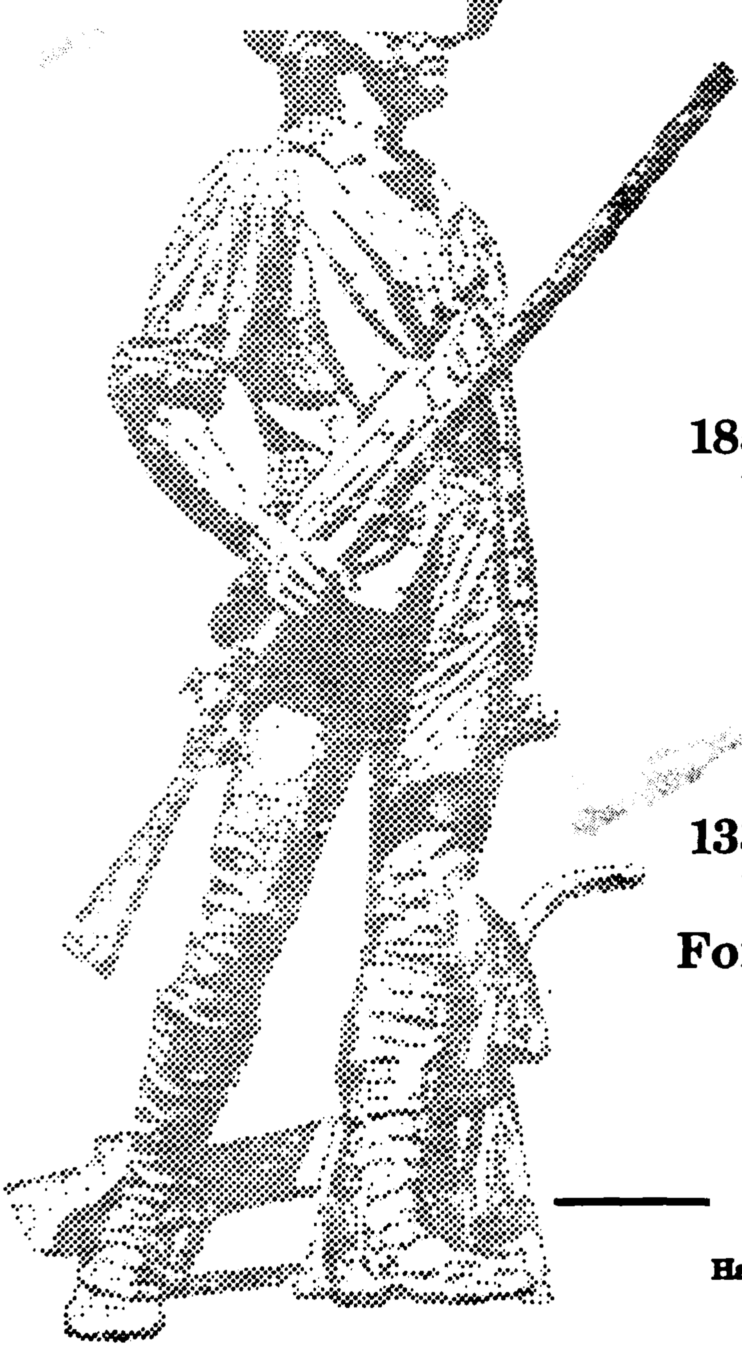

Preliminary Assessment

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185th Tactical Fighter Group
Iowa Air National Guard
Sioux Gateway Airport
Sergeant Bluff, Iowa

and

133rd Tactical Control Flight
Iowa Air National Guard
Fort Dodge Municipal Airport
Fort Dodge, Iowa

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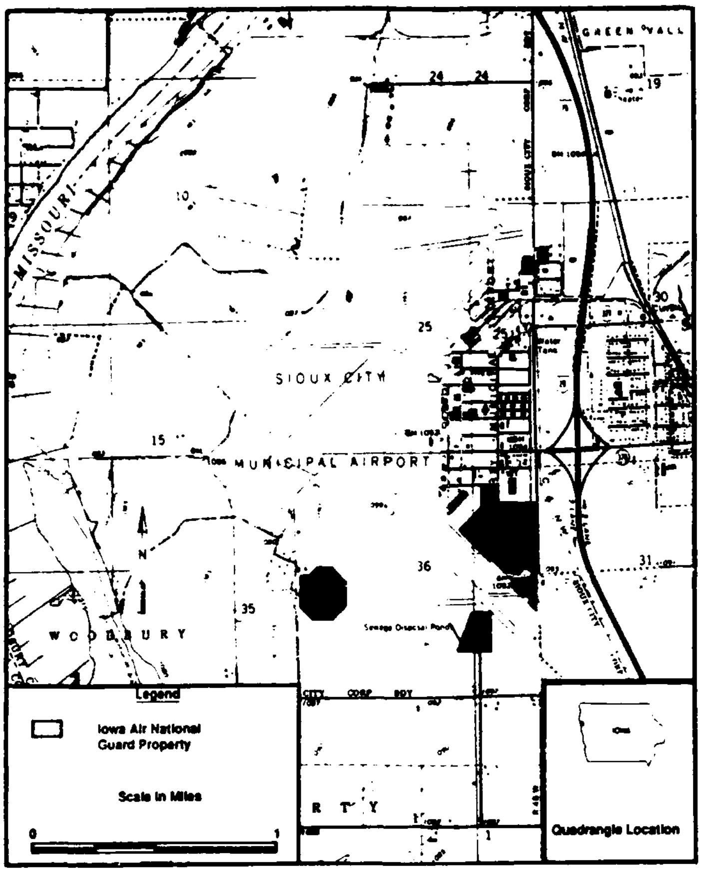
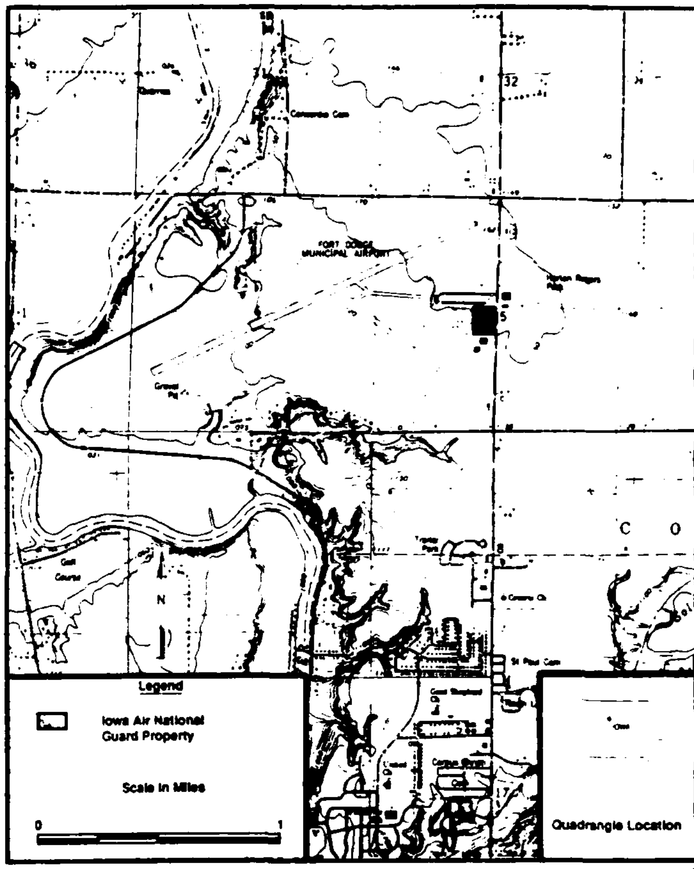
December 1988



Location Map of the 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa.



Location Map of the 133rd TCF, Iowa Air National Guard, Fort Dodge Municipal Airport, Fort Dodge, Iowa.

This report has been prepared for the National Guard Bureau, Andrews Air Force Base, Maryland by the Hazardous Materials Technical Center for the purpose of aiding in the implementation of the Air Force Installation Restoration Program.

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (*Leave blank*)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	December 1988	Final Preliminary Assessment

4. TITLE AND SUBTITLE
Installation Restoration Program
185th Tactical Fighter Group
Iowa Air National Guard
Sioux Gateway Airport, Sergeant Bluff, Iowa; and
133rd Tactical Control Flight, Iowa Air National Guard
Fort Dodge Municipal Airport, Fort Dodge, Iowa

5. FUNDING NUMBERS

6. AUTHOR(S)
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Hazardous Materials Technical Center
The Dynamac Building
11140 Rockville Pike
Rockville, Maryland 20852

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
National Guard Bureau
Andrews Air Force Base, Maryland 20331-6008

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release;
distribution is unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (*Maximum 200 words*)

Preliminary Assessment for suspected hazardous waste sites on the Iowa Air National Guard Bases located at the Sioux Gateway Airport, Sergeant Bluff, Iowa, and Fort Dodge Municipal Airport, Fort Dodge, Iowa. The study was conducted under the Air National Guard Bureau's Istallation Restoration Program.

14. SUBJECT TERMS
Installation Restoration Program
Preliminary Assessment
Iowa Air National Guard

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

INSTALLATION RESTORATION PROGRAM
PRELIMINARY ASSESSMENT

FOR

185th TACTICAL FIGHTER GROUP
IOWA AIR NATIONAL GUARD
SIOUX GATEWAY AIRPORT
SERGEANT BLUFF, IOWA

AND

133rd TACTICAL CONTROL FLIGHT
IOWA AIR NATIONAL GUARD
FORT DODGE MUNICIPAL AIRPORT
FORT DODGE, IOWA

December 1988

Prepared for

National Guard Bureau
Andrews Air Force Base, Maryland 20310

Prepared by

Hazardous Materials Technical Center
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Contract No. DLA 900 82-C 4426

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EXECUTIVE SUMMARY

A. Introduction

The Hazardous Materials Technical Center (HMTC) was retained in August 1988 to conduct the Installation Restoration Program (IRP) Preliminary Assessment (PA) of the 185th Tactical Fighter Group (TFG), Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa (hereinafter referred to as the Base), under Contract No. DLA-900-82-C-4426. Also covered by this Preliminary Assessment is the 133rd Tactical Control Flight (TCF) at the Fort Dodge Municipal Airport in Fort Dodge, Iowa (hereinafter referred to as the Station). The Preliminary Assessment included:

- an onsite visit, including interviews with 29 past and present Base employees conducted by HMTC personnel during 29 August to 2 September 1988;
- the acquisition and analysis of pertinent information and records on hazardous material use and hazardous waste generation and disposal at the Base;
- the acquisition and analysis of available geologic, hydrologic, meteorologic, and environmental data from pertinent Federal, State, and local agencies; and
- the identification of sites on the Base that are potentially contaminated with hazardous materials/hazardous wastes (HM/HW).

B. Major Findings

<u>BASE</u>:

Past Base operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. The Base shops that use and dispose of HM/HW include Aircraft Maintenance; Vehicle Maintenance; Avionics; Aerospace Ground Equipment (AGE) Maintenance; Petroleum, Oils, and Lubricants (POL) Management; Nondestructive Inspection (NDI); Weapons Maintenance; and Corrosion Control. Waste oils, recovered fuels, spent cleaners, strippers, and solvents are generated by these shops.

Interviews with past and present Base personnel and a field survey resulted in the identification of ~~six~~ two sites at the Base that are potentially contaminated with HM/HW. These sites were assigned a Hazard Assessment Score (HAS) according to the U.S. Air Force Hazard Assessment Methodology (HARM).

Site No. 1 - Defueling Pit (HAS-73)

A defueling pit is located north of the old alert hangar (Building No. 241). Excess JP-4 fuel in the F-100 aircraft was dumped into the pit approximately twice per month during the years 1961 to 1976. A total of 180,000 gallons of JP-4 may have been released at this site. At the time of the site visit, the pit was full of water and vegetation around it was stressed.

Site No. 2 - Possible Low-level Radioactive Waste Disposal Area (HAS-34)

The Air Force reportedly used an area within the ammunition storage area west of the Base for the disposal of low-level radioactive wastes, such as radio tubes. The area is approximately 10 feet square and enclosed by a dilapidated wire fence. Several padlocked metal cylinders protrude from the ground within this area. At the time of the site visit, there were no signs of contamination and a geiger counter detected no radioactivity in the vicinity of the fenced area.

STATION:

Past Station operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. The Station shops that use and dispose of HM/HW include Vehicle Maintenance; Aerospace Ground Equipment (AGE) Maintenance; Petroleum, Oils, and Lubricants (POL) Management; and Battery Shop. Waste oils, recovered fuels, sulfuric acid, spent cleaners, strippers, and solvents are generated by these shops. Interviews with Station personnel and a field survey resulted in the identification of no potentially contaminated sites at the Station.

C. Conclusions

BASE:

Information obtained through interviews with past and present Base personnel resulted in the identification of two areas on the Base that are potentially contaminated with HM/HW. At each of the identified sites, the potential exists for contamination of soils, surface water, or groundwater and subsequent contaminant migration. Each site was, therefore, assigned a HAS according to HARM.

STATION:

Information obtained through interviews with Station personnel resulted in the identification of no potentially contaminated sites at the Station.

D. Recommendations

BASE:

Further IRP investigation is recommended for each of the two sites identified at the Base.

STATION:

No further IRP investigation is recommended at the Station.

I. INTRODUCTION

A. Background

The 185th Tactical Fighter Group (TFG) is located at the Iowa Air National Guard Base (hereinafter referred to as the Base) at the Sioux Gateway Airport, Sergeant Bluff, Iowa. The Base was established at its present location in 1957. The Base's tenant unit, the 133rd Tactical Control Flight (TCF) (hereinafter referred to as the Station), was established at the Fort Dodge Municipal Airport, Fort Dodge, Iowa in 1959. Past operations at the Base and the tenant unit involved the use and disposal of materials and wastes that subsequently were categorized as hazardous. Consequently, the National Guard Bureau has implemented its Installation Restoration Program (IRP). The IRP consists of the following:

- Preliminary Assessment (PA) - to identify past spill or disposal sites posing a potential and/or actual hazard to public health or the environment.
- Site Investigation/Remedial Investigation/Feasibility Study (SI/RI/FS) - to acquire data via field studies, for the confirmation and quantification of environmental contamination that may have an adverse impact on public health or the environment and to select a remedial action through preparation of a feasibility study.
- Research, Development, and Demonstration (RD & D) - if needed, to develop new technology for accomplishment of remediation.
- Remedial Design/Remedial Action (RD/RA) - to prepare designs and specifications and to implement site remedial action.

B. Purpose

The purpose of this Preliminary Assessment is to identify and evaluate suspected problems associated with past hazardous waste handling procedures, disposal sites, and spill sites on the Base. Personnel from the Hazardous Materials Technical Center (HMTC) visited the Base, reviewed existing environmental information, analyzed Base records concerning the use and generation of hazardous

material/hazardous waste (HM/HW), and conducted interviews with past and present Base personnel familiar with past hazardous materials management activities.

A physical inspection was made of the various facilities and of the suspected sites. Relevant information collected and analyzed as a part of the Preliminary Assessment included the history of the Base, with special emphasis on the history of the shop operations and their past HM/HW management procedures; local geologic, hydrologic, and meteorologic conditions that may affect migration of contaminants; local land use and public utilities that could affect the potential for exposure to contaminants; and the ecologic settings that indicate environmentally sensitive habitats or evidence of environmental stress.

C. Scope

The scope of this Preliminary Assessment is limited to operations at the Base and includes:

- An onsite visit;
- The acquisition of pertinent information and records on hazardous materials use, hazardous wastes generation, and disposal practices at the Base;
- The acquisition of available geologic, hydrologic, meteorologic, land use, critical habitat, and utility data from various Federal, State, and local agencies;
- A review and analysis of all information obtained; and
- The preparation of a report to include recommendations for further actions.

The onsite visit and interviews with past and present Base personnel were conducted during the period 29 August to 2 September 1988. The Preliminary Assessment was conducted by Raymond G. Clark, Jr., P.E./Department Manager; Ms. Janet S. Emry, Hydrogeologist/Task Manager; and Ms. Leslie Bond, Mechanical Engineer. Other HMTC personnel who assisted with the Preliminary Assessment include Mr. Mark Johnson, P.G./Program Manager (Appendix A). Personnel from the

Air National Guard Support Center who assisted in the Preliminary Assessment include Mr. Leroy Banicki (Project Officer) and Mr. Russ Dyer (Alternate Project Officer). The Point of Contact (POC) at the Base was Capt. Gary Prescott, Base Civil Engineer (BCE).

D. Methodology

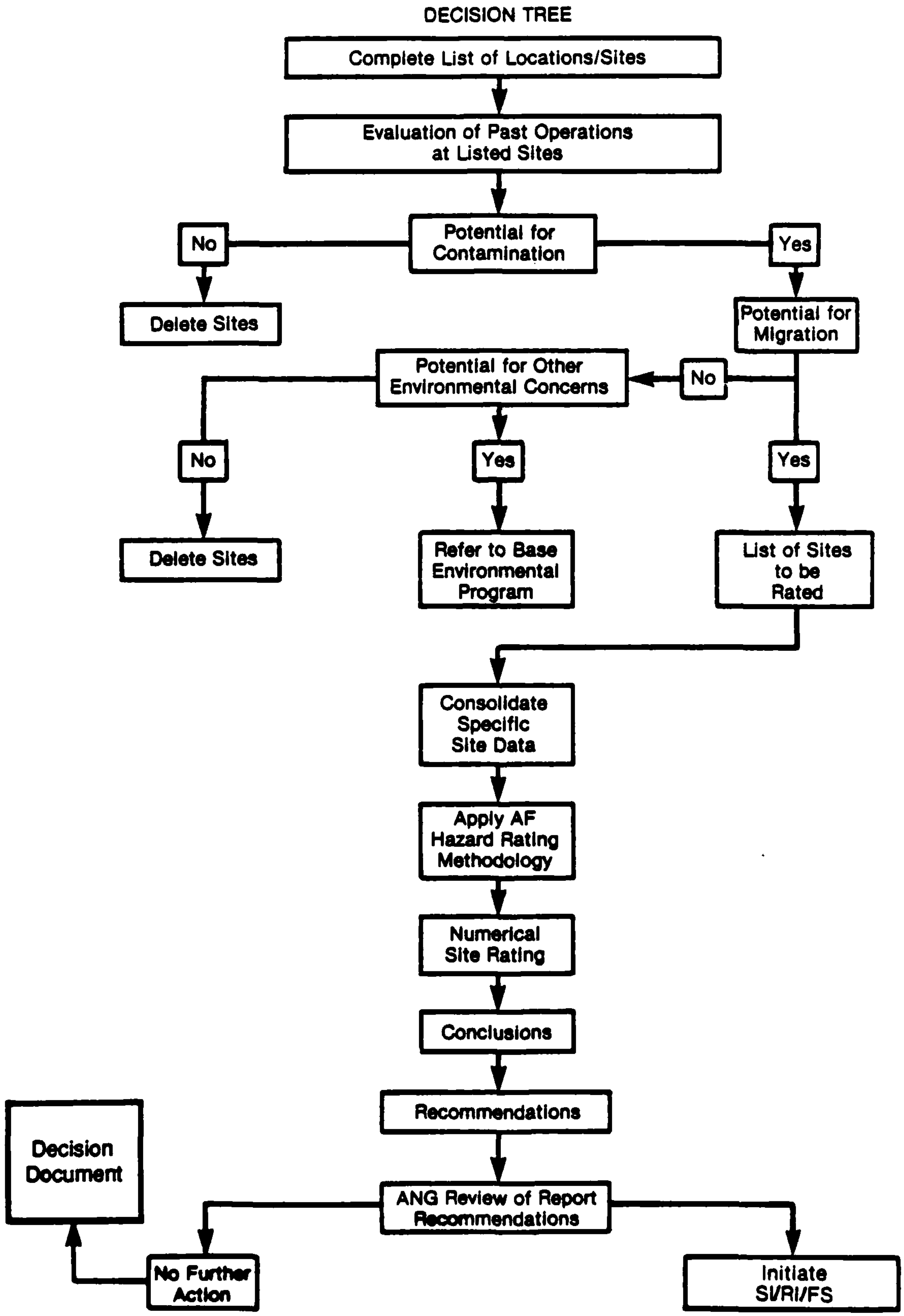
A flow chart of the Preliminary Assessment Methodology is presented in Figure 1. This methodology ensures a comprehensive collection and review of pertinent site-specific information and is used in the identification and assessment of potentially contaminated hazardous waste spill/disposal sites.

The Preliminary Assessment begins with a site visit to the Base to identify all shop operations or activities on the installation that may use hazardous materials or generate hazardous wastes. Next, an evaluation of both past and present HM/HW handling procedures is made to determine whether any environmental contamination has occurred. The evaluation of past HM/HW handling practices is facilitated by extensive interviews with past and present employees familiar with the various operating procedures at the Base. These interviews also define the areas on the Base where any HM/HW, either intentionally or inadvertently, may have been used, spilled, stored, disposed of, or otherwise released into the environment.

Historic records contained in the Base files are collected and reviewed to supplement the information obtained from interviews. Using this information, a list of HM/HW spill/disposal sites on the Base is identified for further evaluation. A general survey tour of the identified sites, the Base, and the surrounding area is conducted to determine the presence of visible contamination and to help assess the potential for contaminant migration. Particular attention is given to locating nearby drainage ditches, surface water bodies, residences, and wells.

Detailed geologic, hydrologic, meteorologic, land use, and environmental data for the area of study is also obtained from the POC, and from appropriate Federal,

Figure 1.
Preliminary Assessment Methodology Flow Chart.



State, and local agencies. A list of outside agencies contacted is in Appendix B. Following a detailed analysis of all the information obtained, areas are identified as suspect areas where HM/HW disposal and/or spills may have occurred. Where sufficient information is available, sites are assigned a Hazard Assessment Score (HAS) using the U.S. Air Force Hazard Assessment Rating Methodology (HARM) and the HARM Guidelines (Appendix C). However, the absence of a HAS does not necessarily negate a recommendation for further IRP investigation, but rather may indicate a lack of data. The HAS is computed from the HARM Guidelines and from the data included in the Factor Rating Criteria. (Appendix D).

II. INSTALLATION DESCRIPTION

A. Location

BASE:

The 185th TFG of the Iowa Air National Guard is located at the Sioux Gateway Airport, Sergeant Bluff, Iowa. Sioux Gateway Airport is located in the west-central region of Iowa, approximately 7 miles south of downtown Sioux City, in Woodbury County. The Base is located in Township 88 North, Range 47 West, Sections 25 and 36. The Base presently leases a total of 90 acres in nine separate land parcels on the eastern portion of the Sioux Gateway Airport from the City of Sioux City. Figure 2A shows the location and boundaries of the Base property covered by this Preliminary Assessment.

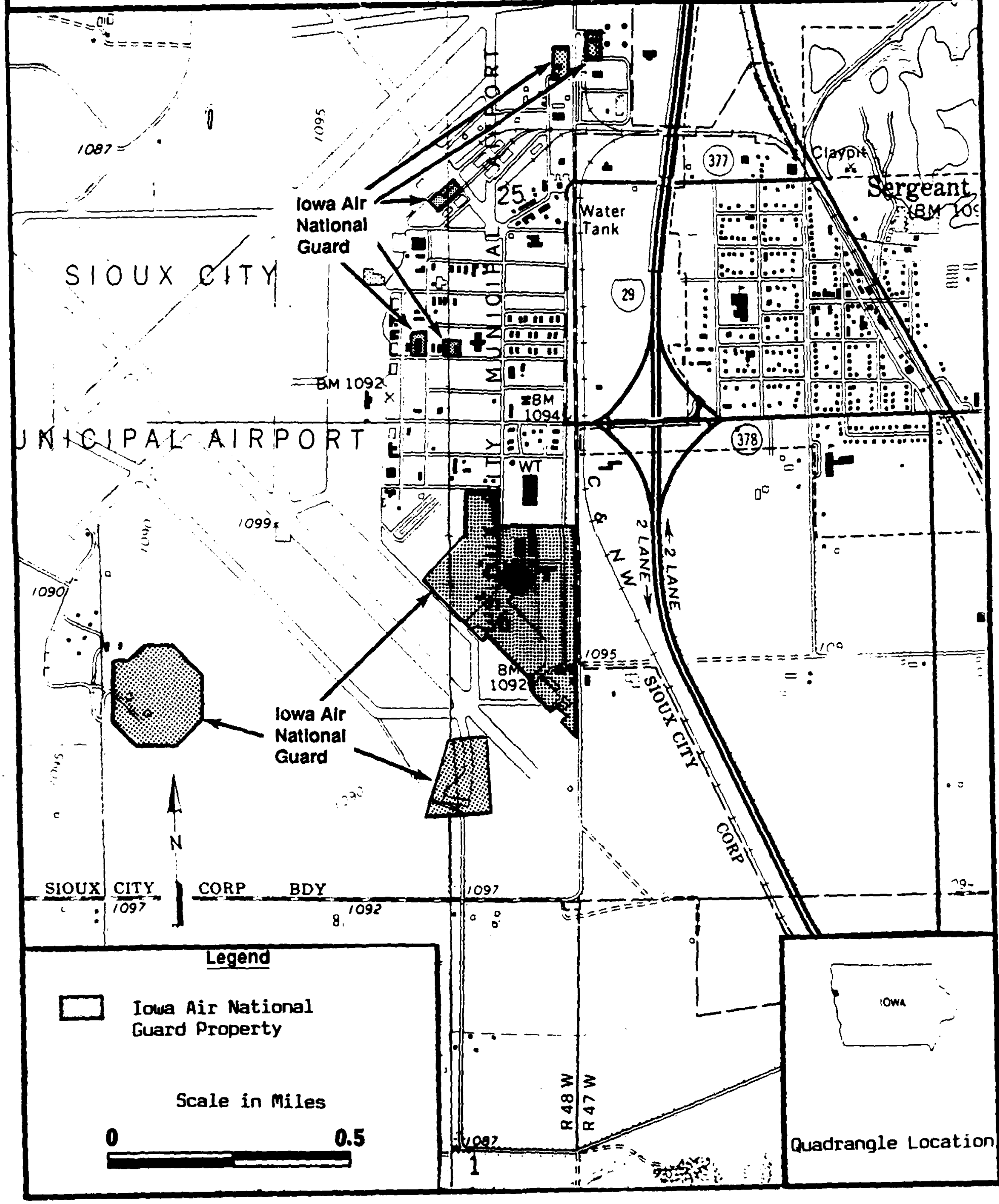
Property north of the Base includes the former Sioux City Air Base, which is now a mixture of commercial and residential property. West of the Base is the airport and the Missouri River, which is 2 miles from the Base. Property south and east of the Base is primarily agricultural and residential. Approximately 0.75 miles northeast of the Base is the residential community of Sergeant Bluff, Iowa. The population within a 1-mile radius of the Base is calculated by counting the residential property shown in Figure 2A and assuming that each dwelling has 3.8 residents (47 FR 31233). The residential population is estimated to be 1,542 and Base personnel population is 268. The total population within the 1-mile radius of the Base is 1,810.

STATION:

The 133rd TCF of the Iowa Air National Guard is located 2 miles north of the City of Fort Dodge, in Webster County, Iowa, and is approximately 115 miles east of the Base. The 133rd is located in Township 89 North, Range 28 West, Section 5. The 133rd occupies 8.1 acres on the east side of the Fort Dodge Municipal Airport. The location and boundaries of this property are shown in Figure 2B.

Source: U.S.G.S. Map 7.5 minute series Topographic Quadrangles, Sioux City South and Sergeant Bluff, Iowa.

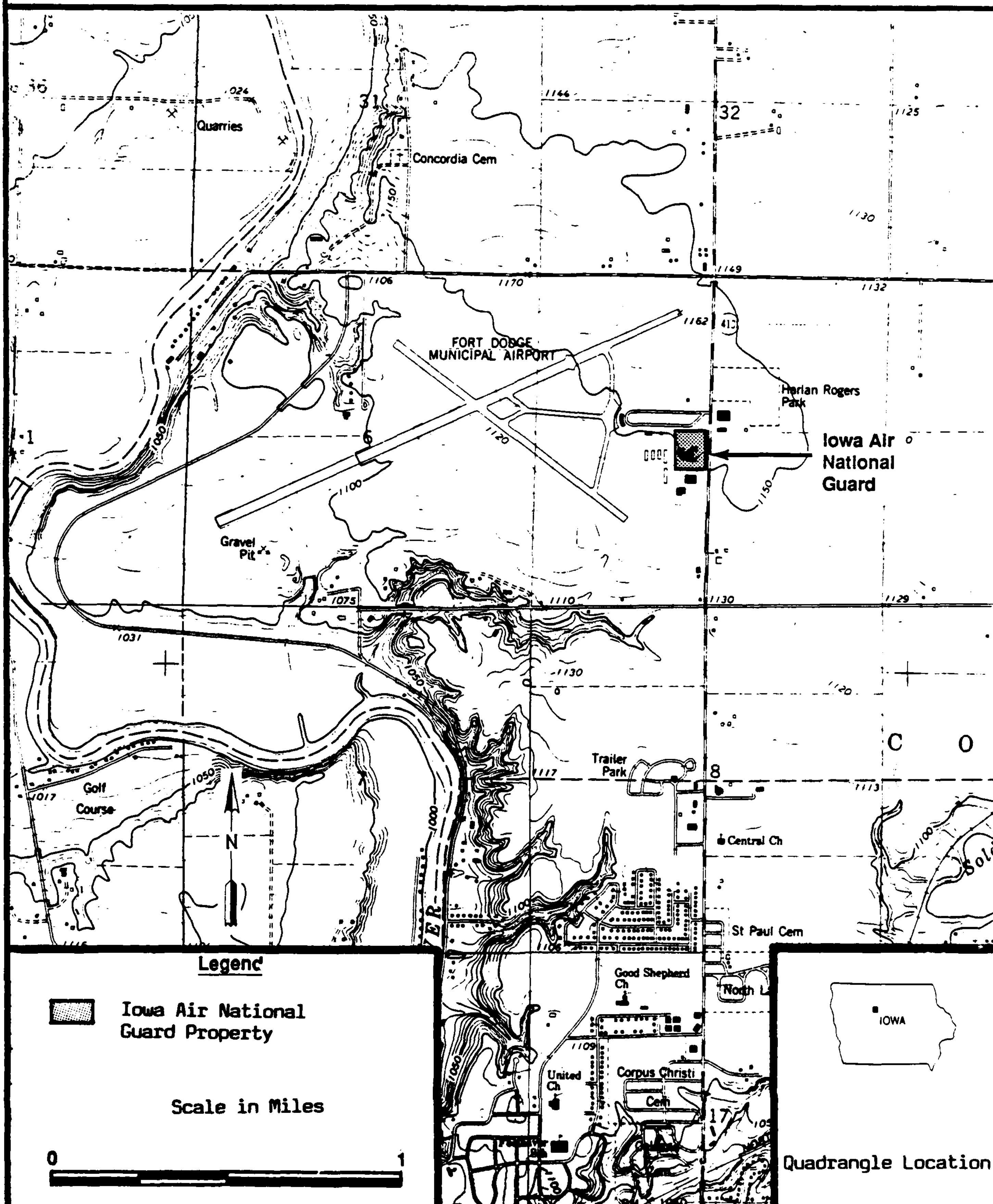
Figure 2A. Location Map of the 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa.



HMTC

Source: U.S.G.S. Map
7.5 minute series
Topographic Quadrangle,
Fort Dodge North, Iowa.

Figure 2B.
Location Map of the 133rd TCF, Iowa Air National Guard, Fort Dodge Municipal Airport, Fort Dodge, Iowa.



Property surrounding the airport is primarily agricultural. The residential population within a 1-mile radius of the 133rd TCF is estimated to be 240 (calculated according to 47 FR 31233 using Figure 2B) and Base personnel population is 25. The total population within a 1-mile radius is 265.

B. History of Base Operations

The 386th Fighter Squadron had its beginning in World War II, serving in England, France, Belgium, and Germany. Following World War II, the 386th was deactivated and allotted to Iowa where it was redesignated the 174th Fighter Squadron.

On 2 December 1946, the 174th was organized at the National Guard Armory with the following units: the 174th Fighter Squadron Detachment B, the 232nd Air Service Group, the 174th Weather Station, and the 174th Utility Flight. On 1 February 1947, the 174th was quartered in available buildings at the Sioux City Municipal Airport. At the same time the first T-6 aircraft arrived. In the same month, the first F-51 "Mustangs" were assigned.

On 1 May 1950, the changeover to F-84 "Thunderjet" aircraft began. In October 1950, the organization of the Air National Guard was changed to the combat wing and the 174th was redesignated as a fighter squadron and was augmented with elements of the support squadrons.

On 1 April 1951, the Squadron was activated and moved to Dow Air Force Base (AFB) in Bangor, Maine. The unit started the move on the 5th of April and by the 13th all of the personnel and equipment had left Sioux City. The unit was deactivated on 31 December 1952, returned to Sioux City, and was redesignated the 174th Fighter Bomber Squadron. The squadron transitioned to F-80 aircraft in July of 1953. On 1 July 1955, the 174th was redesignated a Fighter Interceptor Squadron. In August of 1956, the outmoded F-80 "Shooting Stars" were replaced by F-84Es. On 1 September of 1956, the squadron strength totaled 44 officers and 387 airmen.

The dedication of the 185th's present facilities was on the 22nd of September 1957. On 10 April of 1958, the 174th was again redesignated a Tactical Fighter Squadron and was assigned to the 140th Tactical Fighter Wing at Denver, Colorado. The unit received its first F-100C on 3 June 1961.

The biggest organizational change was the reorganization and redesignation of the 185th Tactical Fighter Group on 1 October 1962. This reorganization nearly doubled the manpower, authorizing over 800 officers and airmen. On 15 January 1968, the new Operations and Training building was completed and occupied.

On 26 January 1968, the 185th was again recalled to active duty as a result of the "Pueblo Crisis". Starting on 11 May 1968, the 174th Tactical Fighter Squadron, augmented by many other 185th personnel, deployed to Phu Cat AB, Viet Nam. During the following three months, the remaining members of the 185th were deployed to bases in Korea, Taiwan, and the continental United States. In May of 1969, the men and aircraft of the 185th were returned to Sioux City for deactivation.

The 185th received the A-7D "Corsair II" in 1976, after 15 years with the F-100 "Super Sabre". The A-7D continues to fulfill the exacting requirements of the close air support mission of the 185th TFG while being equally effective in the interdiction (attack) roles assigned to it.

The current approximate strength of the 185th Tactical Fighter Group is 800 military members and 268 full-time Federal and State employees. The 185th now has 30 major facilities, including a hangar and office building, supply building, fire station, civil engineering shops, a complete motor pool and separate buildings for the engine shop, operations, fuel cell repair and avionics. Since the closing of the Sioux City Air Force Base, the 185th has also acquired the former headquarters building (which now houses the Communications Flight), dormitories, warehousing space, ammunition storage facilities, a test cell and POL facilities. The land upon which these facilities are located is leased from the City of Sioux City on a 25-year issue.

C. History of Station Operations

The 133rd Aircraft Control and Warning Squadron was originally organized and extended Federal recognition on 1 June 1948. The unit was headquartered at Fort Dodge, Iowa.

Early in 1951 the 133rd Aircraft Control and Warning Squadron was alerted for active duty, to be effective 1 November 1951 for a period of 24 months. Approximately 50 officers and airmen were placed on active duty on 1 September 1951 to inventory, pack, and crate all equipment for shipment to the active duty site at Alexandria Air Force Base (AFB), Louisiana. A small cadre of officers and airmen was assigned to Alexandria AFB in November of 1951 to prepare the housing area designated for the 133rd. The main body arrived at Alexandria AFB in the early part of December 1951. Personnel then departed for overseas assignments, various service schools, and normal transfers. Most of the overseas assignments were to Korea and Germany.

The unit was reorganized and redesignated the 133rd Aircraft Control and Warning Flight effective 1 November 1953, with an authorized strength of 33 officers, 1 warrant officer, and 281 airmen. The unit was again organized at the airport at Fort Dodge, Iowa. Effective 1 March 1954, the 133rd Aircraft Control and Warning Flight was assigned to the 157th Tactical Control Group at St. Louis, Missouri.

On 1 September 1965 the unit was reorganized as the 133rd Tactical Control Flight; this status required a 50 percent increase in the number of training assemblies with acceleration in all phases of training. The unit was authorized to go to full manning as one of the selected Air National Guard units to be placed on active duty in case of a Vietnam mobilization of reserve forces.

The 133rd Tactical Control Flight was deactivated on 31 October 1971 and reactivated as the 133rd Tactical Control Squadron effective 1 November 1971, with an authorized strength of 27 officers and 213 airmen. The 133rd Tactical Control Squadron was realigned effective 1 May 1972 with an authorized strength of 26 officers and 204 airmen.

On 1 November 1972 the 133rd Tactical Control Flight was organized and assigned to Fort Dodge, Iowa, with an authorized strength of 5 officers and 43 airmen.

III. ENVIRONMENTAL SETTING

A. Meteorology

<u>BASE</u>:

According to the National Oceanic and Atmospheric Administration (NOAA), the climate of the Sioux City area is typically continental, controlled by the movement and interaction of large-scale weather systems. This climate is characterized by cold winters and warm summers, with considerable fluctuation in temperature and precipitation from season to season and from year to year.

Annual precipitation in the Sioux City area averages 25.57 inches. Net precipitation is calculated by subtracting the mean annual lake evaporation from the average annual precipitation (47 FR 31224). Mean annual lake evaporation for the Sioux City area is 38 inches (47 FR 31227) and net precipitation, therefore, is negative 12.43 inches per year. Approximately 75 percent of the annual precipitation falls as showers during the warm season from April to September. Maximum rainfall intensity, based on a 1-year, 24-hour rainfall is 2.25 inches (47 FR 31235).

<u>STATION</u>:

The climate of the Fort Dodge area is also continental in nature. Annual precipitation in the Fort Dodge area averages 30.2 inches (Koppen, 1975) and mean annual lake evaporation is 36 inches (47 FR 31227). Net precipitation, therefore, is negative 5.8 inches per year. Maximum rainfall intensity is 2.6 inches (47 FR 31235).

B. Geology

BASE:

The Base is located approximately 2 miles east of the Missouri River, within the Missouri Alluvial Plain physiographic province. The alluvial plain, characterized by a nearly level land surface adjacent to the Missouri River, was produced by extensive deposition of alluvium by the river during the Pleistocene epoch, when the river carried drainage from glacial meltwaters.

The topography of the Base is relatively flat, at elevations ranging from 1,089.5 to 1,093.6 feet above mean sea level (MSL). The alluvial plain of the Missouri River in the vicinity of the Base is gently undulating, at elevations between 1,075 and 1,100 feet above MSL. The Base is underlain by alluvium, unconsolidated sands, gravels, silts, and clays ranging in thickness from 100 to 160 feet. The 100- to 150-foot high bluffs east and west of the Missouri River valley are at an average elevation of 1,200 feet above MSL. The bluffs are composed of unconsolidated loess and glacial till of Quaternary age (Buchmiller, 1986).

The bedrock beneath the Missouri Alluvial Plain is composed of sedimentary rocks of Cretaceous age. These rocks dip toward the northwest at approximately 4 feet per mile. The upper most bedrock unit is the Carlile Shale, a dark-gray, calcareous, thinly laminated marine shale. This formation ranges in thickness from 80 feet in Iowa up to 200 feet in South Dakota (Munter and others, 1983).

Underlying the Carlile Shale is the Greenhorn Limestone, which consists of thin- to medium-bedded, fossiliferous, shaly, chalky limestone. The Greenhorn has a maximum thickness of 30 feet in Iowa (Munter and others, 1983).

Beneath these formations is the Dakota Formation. The upper portion of the Dakota Formation, known as the Woodbury Member, consists of interbedded shale, siltstone, and sandstone. The lower part, known as the Nishnabotna Member, is

dominantly a micaceous sandstone. The thickness of the Nishnabotna Member varies from 60 to 370 feet (Munter and others, 1983; Burkart, 1984).

Unconformably underlying the Cretaceous rocks are Paleozoic limestones, dolomites, shales, and sandstones. These rocks dip approximately 18 feet per mile toward the south-southeast. In the vicinity of the Base, the top of the Paleozoic rocks occurs about 737 feet below the land surface (Munter and others, 1983; Burkart, 1984). Figure 3 shows the sequence of these stratigraphic units in northwest Iowa.

STATION:

The Station is located within the Des Moines Lobe physiographic province. The Des Moines Lobe is formed of the Cary till, which is late Wisconsinan in age. These deposits are relatively young (deposited about 12,000 to 14,000 years ago) and are characterized by poorly developed drainage networks, knob-and-kettle topography, a variety of morainal features, and valley-type outwash systems (Munter and others, 1983).

The topography in the vicinity of the Station is gently sloping toward the southwest, toward an unnamed tributary to the Des Moines River. Elevation at the Station ranges from 1,151 feet above MSL in the northeast corner of the property to 1,145 feet above MSL in the southwest corner. The Des Moines River is entrenched within its valley, at an elevation of approximately 1,000 feet above MSL.

The Station is underlain by the Cary till. Stratigraphic logs from wells near the Station indicate that the till ranges from 40 to 85 feet in thickness. Unconformably underlying the surficial glacial sediments is a 10- to 30-foot thick gypsum unit of late Permian age. The gypsum is gray and white in color and is regularly stratified. In some localities, the gypsum is entirely eroded away (Wilder, 1902).

HMTC Source: Munter and Others, 1983.

Figure 3.
Stratigraphic and Hydrostratigraphic Units of Northwest Iowa.

Era	System	Formation	Description	Hydrostratigraphic unit
Cenozoic	ernary	undifferentiated	sand and gravel near streams	alluvial aquifers
			loess, wind blown silt mantling uplands and terraces	minor aquifers grading to leaky confining unit
			till, poorly sorted fine-textured glacial sediment	regional confining unit commonly 200-400 feet thick
			sand or sand and gravel within or between tills or beneath tills in bedrock valleys.	intertill or buried channel aquifers, locally highly productive.
Mesozoic	Cretaceous	Carlile	calcareous black marine shale	regional confining beds, where present. Weathered Greenhorn may yield small amounts of water.
		Greenhorn	chalky limestone, shaly	
		Graneros	calcareous marine shale	
		Dakota: Woodbury Member	interbedded shale, sandstone and lignite. Thickness and extent variable	Dakota aquifer: minor aquifer grading to confining unit. Low to moderate yields to wells
		Dakota: Nishnabotna Member	Massive sandstone, medium to coarse grained, with shale interbeds. Commonly over 200 feet thick.	Dakota aquifer: major aquifer in much of northwest Iowa.
Paleozoic	Pennsylvanian	undifferentiated	mostly shale, with some sandstone, limestone and coal	confining unit not extensive in northwest Iowa.
	Mississippian	undifferentiated	limestone and dolostone	low to moderate yields to wells, significant aquifer only where near land surface.
	Devonian	undifferentiated	dolostone, shaly near top	
	Ordovician	Maquoketa	dolostone	
		Galena	dolostone	
		Decorah	shale	regional confining unit
		Platteville	shale and shaly dolostone	
		Glenwood	shale and oolitic ironstone	
		St. Peter	sandstone, fine-grained and shaly.	Major regionally extensive aquifer
		Prairie du Chien Group	dolostone and shale	
	Cambrian	Jordan	sandstone, medium-grained, dolomitic	
		St. Lawrence	dolostone	No major aquifers
		Davis	shale, some sandstone and dolostone	
		Bonneterre	dolostone, silty	
		Mt. Simon	sandstone	
Precambrian		Sioux	quartzite and argillite, commonly weathered at top, low yields to wells	effective base of ground-water systems
		undifferentiated	igneous and metamorphic rocks, very low water-bearing capacity.	

Underlying the gypsum are Pennsylvanian-age shales, sandstones, and argillaceous limestones. Productive coal seams are interbedded with these units. The shales often contain crystals of selenite gypsum. These units reach a maximum thickness of about 60 feet (Wilder, 1902).

Beneath the Pennsylvanian rocks are Mississippian-age limestones, dolomites, shaly marls, and calcareous sandstones. These units range in thickness from a few feet up to 100 feet (Wilder, 1902).

C. Soils

BASE:

According to the U.S. Soil Conservation Service Soil Survey of Woodbury County, Iowa, the soils at the Base consist of the Albaton clay (156), the Haynie silt loam (137), the Onawa silty clay (146), and the Blake silty clay loam (144). These soils are not subject to sheet and gully erosion. Figure 4A delineates the occurrence of these soils within the vicinity of the Base.

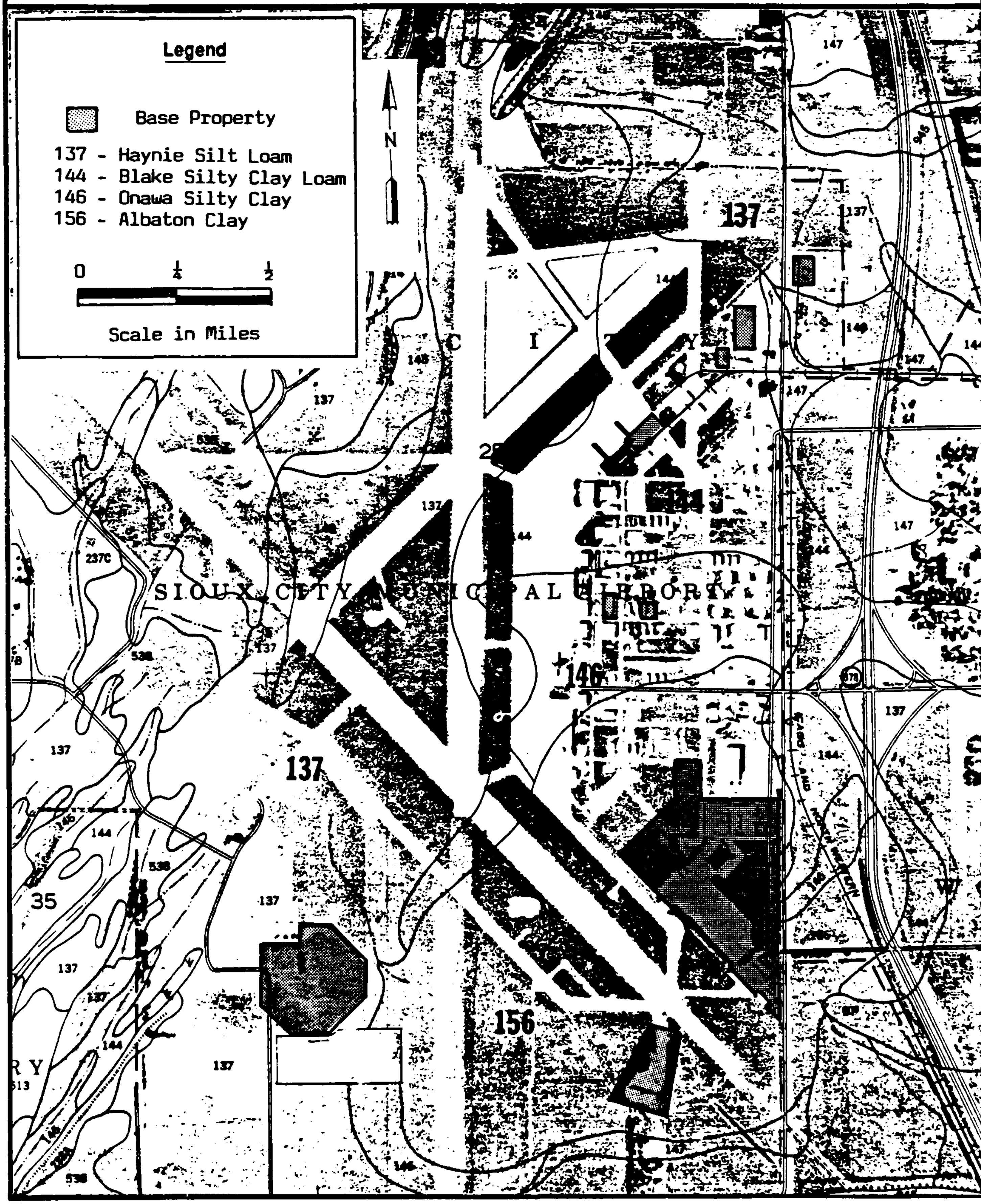
The main portion of the Base and the alert hangar are located in the Albaton clay (156), a calcarious, moderately dark colored, poorly drained soil that formed in river flood plain sediments. The surface layer of the Albaton soil is a firm, mildly alkaline, very dark gray clay about 6 inches thick. The subsoil is about 12 inches thick and consists of a dark grayish-brown moderately alkaline clay with reddish-brown mottles. The underlying soil, to a depth of 60 inches, consists of a stratified, moderately alkaline, dark gray and grayish-brown clay with reddish-brown to pale-brown mottles. Permeability of the Albaton clay is very slow (less than 1.41×10^{-5} cm/sec).

The POL above ground storage tank and the ammunition storage area are located on the Haynie silt loam (137), a calcareous, moderately dark colored, well drained to moderately well drained silty soil that formed in stratified river sediments. The surface layer of the Haynie soil is a mildly alkaline, very dark grayish-brown heavy silt loam about 7 inches thick. The subsoil is about 3 inches thick and

HMTC

Source: Soil Survey of Woodbury County, Iowa. USDA Soil Conservation Service, 1972.

Figure 4A.
Soil Map of the 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa.



consists of a very dark grayish-brown mildly alkaline silty loam. The underlying soil, to a depth of 90 inches, is a stratified, dark grayish-brown silt loam with a few yellowish- and reddish-brown mottles below a depth of 20 inches. Permeability of the Haynie silt loam is moderate (from 4.45×10^{-4} to 1.41×10^{-3} cm/sec).

The Communications building and the barracks are located on the Onawa silty clay (146), a moderately dark colored, somewhat poorly drained to poorly drained clayey soil that formed in sediments in the Missouri River valley. The surface layer of the Onawa soil is about 7 inches thick and consists of a noncalcareous, mildly alkaline, very dark gray silty clay. The subsoil is a calcareous, stratified, mildly alkaline dark gray to dark grayish-brown silty clay about 22 inches thick. The substratum, to a depth of 60 inches, consists of a calcareous, stratified, moderately alkaline, dark gray and grayish-brown silt loam with dark reddish brown, dark brown, or light gray mottles. Permeability of the Onawa silty clay is slow (from 4.24×10^{-5} to 1.41×10^{-4} cm/sec) in the upper 29 inches of the soil profile and is moderate or moderately rapid (from 4.45×10^{-4} to 4.24×10^{-3} cm/sec) in the lower 31 inches of the soil profile.

The POL truck fill stands and the old test cell are located on the Blake silty clay loam (144), a calcareous, moderately dark colored, somewhat poorly drained, silty soil that formed in river flood plain sediments. The surface layer of the Blake soil is about 8 inches thick and consists of a mildly alkaline, very dark grayish-brown silty clay loam with pale-brown to pale-olive mottles. The subsoil is a stratified, moderately alkaline, very dark grayish-brown and dark grayish-brown silty clay loam about 12 inches thick. The subsoil also contains pale-brown to pale-olive mottles. The underlying soil, to a depth of 60 inches, consists of a moderately alkaline, stratified, dominantly grayish-brown silt loam with strong-brown and dark reddish-brown mottles. Permeability of the Blake silty clay loam is moderately slow to moderate (from 1.41×10^{-4} to 4.45×10^{-4} cm/sec) in the upper 20 inches of the soil profile and moderate or moderately rapid (from 4.45×10^{-4} to 4.24×10^{-3} cm/sec) in the lower 40 inches of the soil profile.

STATION

According to the U.S. Soil Conservation Service Soil Survey of Webster County, Iowa, the soils at the Station are classified as made land, areas of land so altered by construction or obscured by structures that identification of the soil is difficult or impossible. The soils in the vicinity of the 133rd TCF belong to the Webster-Clarion-Nicollet association, which are dark colored, poorly drained to well drained soils that formed in glacial till. Erosion by surface runoff is a hazard on the sloping soils in this association. Figure 4B delineates the occurrence of these soils within the vicinity of the Station.

The poorly drained Webster soils (107), which occur mainly in swales and flats, have a surface layer of black gritty silty clay loam about 18 inches thick. The subsoil is olive-gray clay loam. Underlain by light olive-gray loam. Permeability of the Webster soils is moderate (4.45×10^{-4} to 1.41×10^{-3} cm/sec) in the upper 24 inches of the soil profile; moderately slow to moderate (1.41×10^{-4} to 1.41×10^{-3} cm/sec) in the middle 12 inches; and moderate (4.45×10^{-4} to 1.41×10^{-3} cm/sec) in the lower 30 inches of the soil.

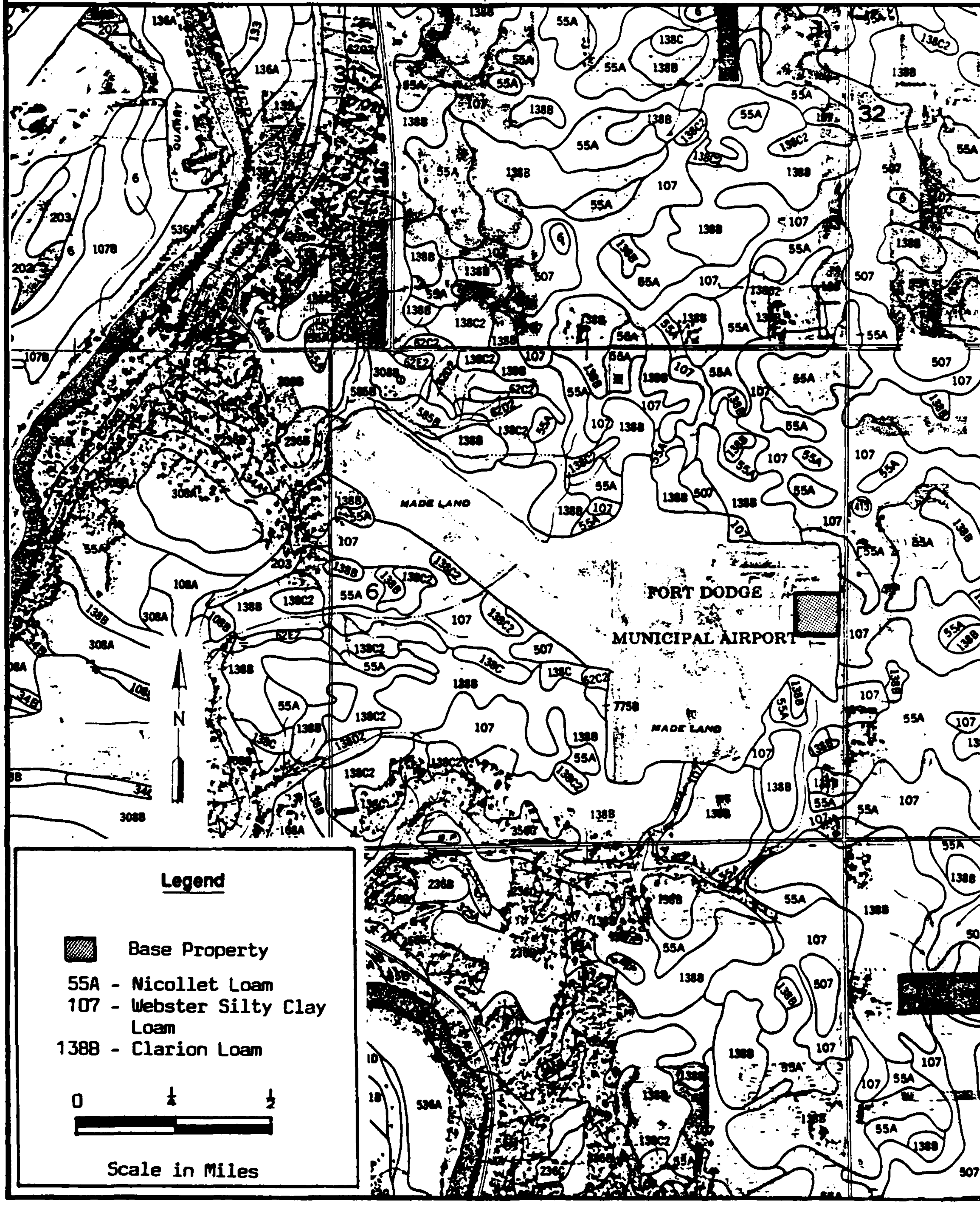
The well drained Clarion soils (138), which occur on knolls and rises, have a surface layer of very dark brown loam about 11 inches thick. The subsoil is dark brown, brown, and dark yellowish-brown friable loam. Permeability of the Clarion soils is moderate (4.45×10^{-4} to 1.41×10^{-3} cm/sec).

The somewhat poorly drained Nicollet soils (55A), which occur on convex rises, have a surface layer of black heavy loam and light clay loam about 15 inches thick. The subsoil is very dark grayish-brown and dark grayish-brown friable clay loam. Permeability of the Nicollet soils is moderate (4.45×10^{-4} to $1.41.\times 10^{-3}$ cm/sec).

HMTC

Source: Soil Survey of Webster County, Iowa. USDA Soil Conservation Service, 1975.

Figure 4B.
Soil Map of the 133rd TCF, Iowa Air National Guard, Fort Dodge Municipal Airport, Fort Dodge, Iowa.



D. Hydrology

BASE:

Surface Water

The Missouri River flows east from its headwaters in the Rocky Mountains of Montana through North Dakota, and then southeast through South Dakota and Nebraska. It forms part of the western border of Iowa, then flows east through Missouri to its confluence with the Mississippi River at St. Louis. Near Sioux City, Iowa, the Big Sioux and Floyd Rivers join the Missouri. The Missouri River drains approximately 315,000 square miles above Sioux City, and its discharge rate averages 32,000 cubic feet per second. The Missouri River and most of the natural surface water drainages on its flood plain have been channelized and straightened. Small drainage ditches occur along most roadways in the area; these collect surface runoff and excess irrigation water and discharge this water to the larger channelized streams (Buchmiller, 1986). According to the Iowa Department of Natural Resources, the Base is not within the 100-year flood plain of the Missouri River. Although the Base is within the geological flood plain, flood control dams and channelization of the Missouri River has lessened the probability of flooding in this area.

Surface runoff from both the Base and the airport is collected by the storm sewer system and discharged to a ditch which parallels Harbor Drive east of the Base (Figure 5). Until 1984, water within the ditch had no outlet to the river and either evaporated or percolated into the ground. In 1984, the Harbor Drive ditch was reworked and a new perpendicular ditch was constructed leading to the Missouri River.

Groundwater

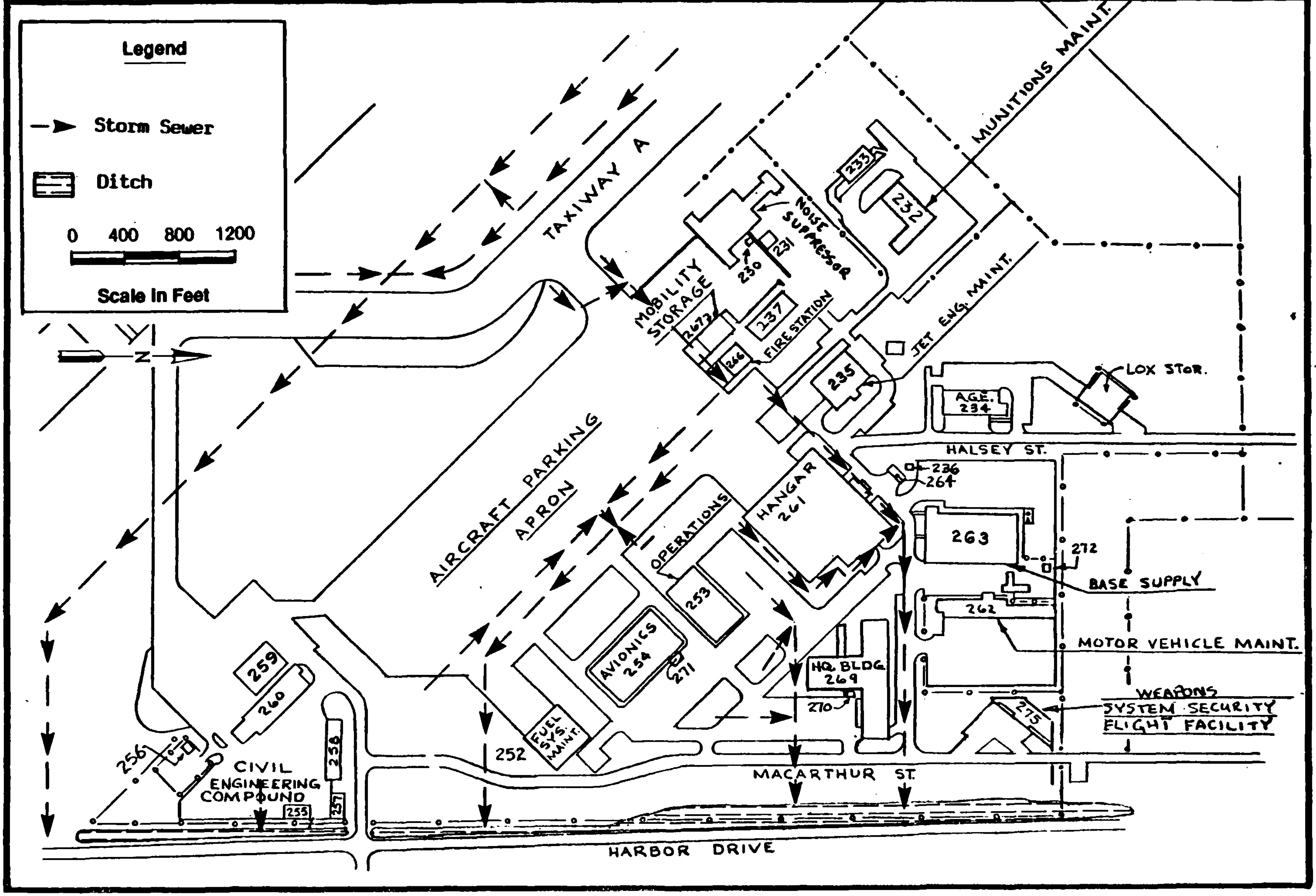
The shallow aquifer within the Missouri River valley consists of the unconsolidated sands, gravels, silts, and clays deposited by the river. This alluvial aquifer is generally unconfined; however, variations in lithology may

Figure 5.

Storm Drainage Map, 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa.

HMTC

Source: 185th TFG, Area Map, 1988.



cause semiconfined or confined conditions to exist in localized areas. Water levels within the aquifer range from near the land surface in topographically low areas to about 20 feet below the land surface in areas of higher elevation on the alluvial plain. Groundwater within the alluvial aquifer discharges to the Missouri River and its tributaries, and water quality within the aquifer is similar to that of the adjacent streams. Shallow groundwater flow beneath the Base is to the southwest, toward the Missouri River. Wells within the shallow aquifer yield up to 5,000 gallons per minute (Buchmiller, 1986).

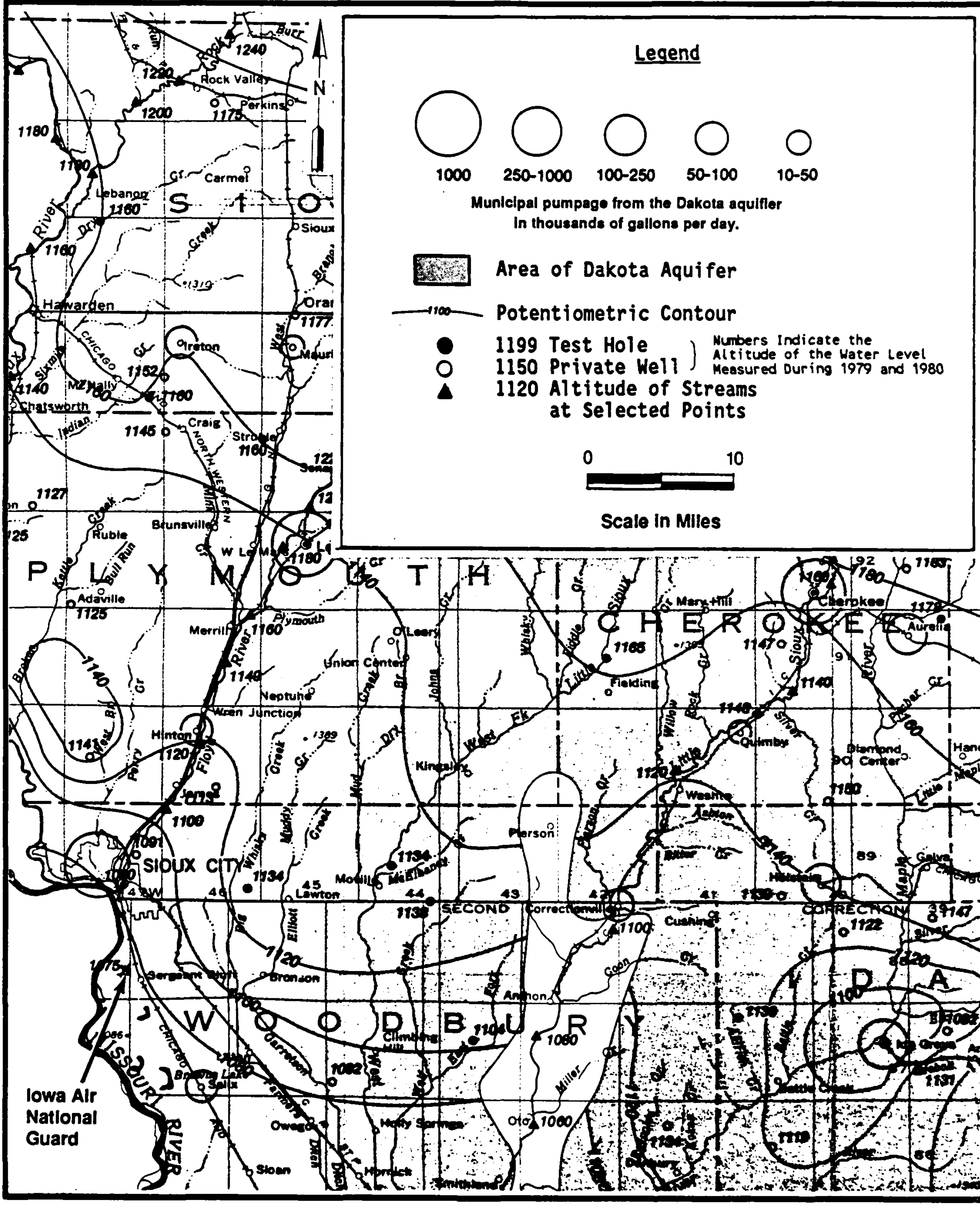
Another important aquifer in the Sioux City area is the Dakota aquifer, which is composed of the thick sandstones within the Dakota Formation. This aquifer is confined by the overlying shales in the Dakota Formation and the other Cretaceous-age shales and limestones. In the vicinity of the Base, the Dakota aquifer is approximately 75 feet thick and occurs about 190 feet below the land surface. Lateral groundwater movement within the Dakota aquifer is toward the southwest and the hydraulic gradient is approximately 5 feet per mile. Figure 6 illustrates the potentiometric surface and municipal withdrawal from the Dakota aquifer. The average hydraulic conductivity of the Dakota aquifer is 40 to 45 feet per day (1.41×10^{-2} to 1.59×10^{-2} cm/sec) (Munter and others, 1983; Burkart, 1984).

There are no water wells on the Base; Sioux City supplies the Base with water from municipal water supplies. Sioux City obtains 90 percent of its water from wells situated along the Missouri River. Five of these wells tap the alluvial aquifer and five tap the Dakota aquifer. The wells range in depth from 80 to 350 feet. The remainder of the city's water is supplied by 6 additional wells in the Dakota aquifer.

Several farms south of the Base obtain their water from the alluvial aquifer. The closest dwelling is located approximately 1,800 feet southwest of the alert hangar (Building No. 241). These wells are reportedly as shallow as 30 feet. The City of Salix, Iowa, located about 8 miles southeast of the Base, also obtains its municipal water from the alluvial aquifer (Buchmiller, 1986).

Source: Burkart, 1984.

Figure 6.
Potentiometric Surface and Municipal Withdrawal From the Dakota Aquifer in Northwest Iowa, 1979-1980.



The Paleozoic rocks underlying the Dakota Formation also include some potential aquifers, especially the Ordovician and Cambrian sandstones and Devonian limestones. Figure 3 (page III-4) indicates the hydrologic potential of each unit in the stratigraphic sequence of northwest Iowa.

STATION:

Surface Water

The East and West Forks of the Des Moines River join approximately 15 miles north of Fort Dodge, Iowa. From Fort Dodge, the Des Moines flows southeast through Iowa, through the city of Des Moines, to its confluence with the Mississippi River near Keokuk, Iowa. According to the Iowa Department of Natural Resources, the Station is not within the 100-year floodplain of the Des Moines River.

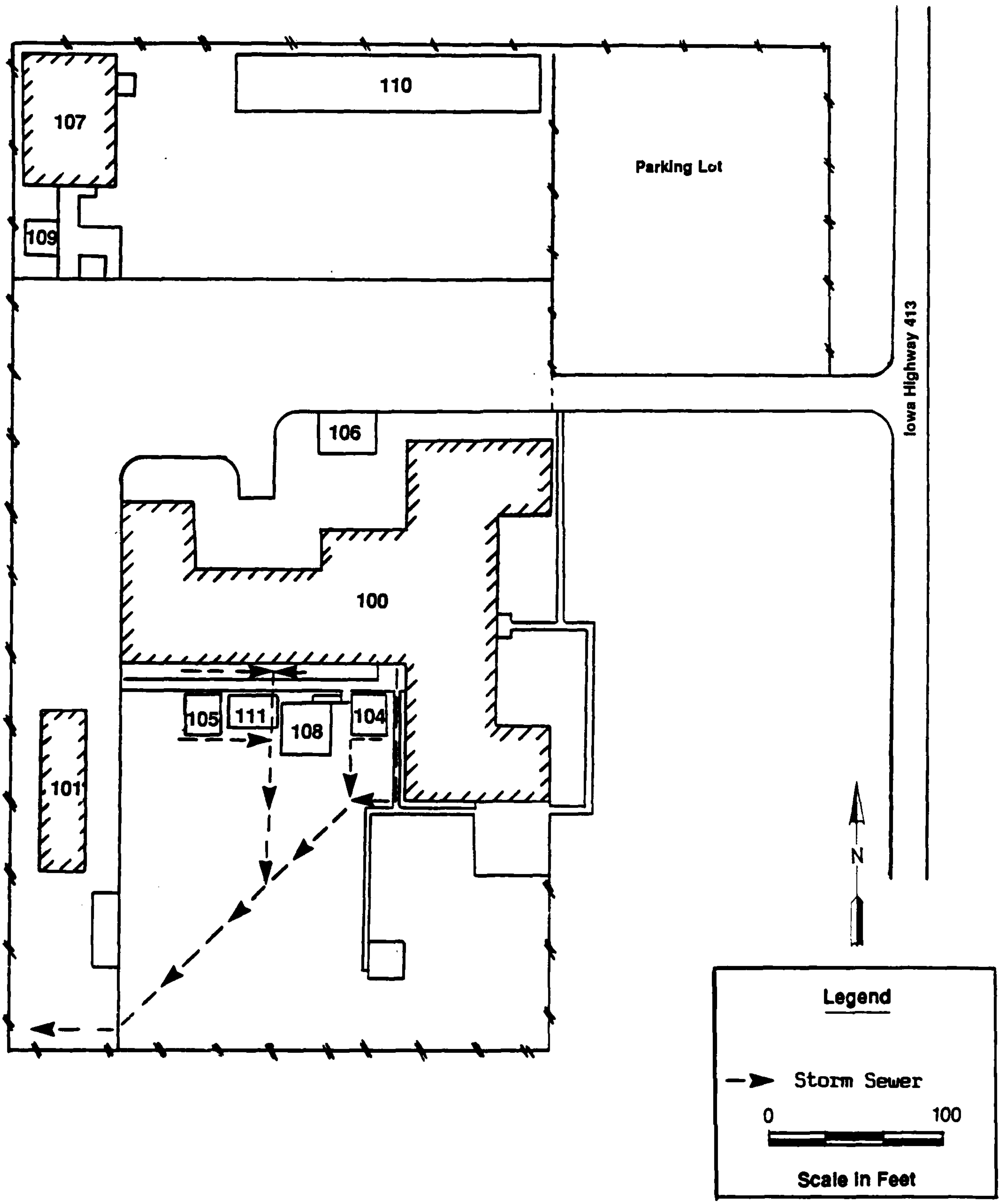
All surface drainage in Webster County, Iowa, enters the Des Moines River or its tributaries. Runoff at the Station enters the storm sewer system, which joins the airport storm drainage system (Figure 7). These systems discharge to an unnamed tributary of the Des Moines River south of the airport or directly to the Des Moines River (see Figure 2B, page II-3).

Groundwater

The surficial sediments at the Station contain lenses of sand and gravel distributed within the silt and clay deposited by the Pleistocene glaciers. These sand and gravel aquifers generally yield only small quantities of water because of their limited areal extent and are therefore usually considered to be unreliable for public or industrial water supplies. These aquifers are also subject to human-induced contamination by nitrates, pesticides, and other organic substances (Buchmiller and others, 1987). Groundwater within the shallow aquifers discharges to the Des Moines River and its tributaries. Groundwater flow beneath the Station is therefore toward the south or southwest.

HMTC Source: Iowa Air National Guard, 1976.

Figure 7.
Storm Drainage Map, 133rd TCF, Iowa Air National Guard, Fort Dodge Municipal Airport, Fort Dodge, Iowa.



The uppermost bedrock aquifer in the vicinity of the Station is the Mississippian aquifer, which consists of limestone and dolomite. Where this aquifer is overlain by the low-permeability Pennsylvanian rocks, it is under confined conditions. The Mississippian aquifer occurs at depths of 40 to 275 feet from the land surface and ranges in thickness from a few feet up to 100 feet. Large concentrations of naturally-occurring dissolved solids within this aquifer limit its use in many areas (Buchmiller and others, 1987).

The Silurian-Devonian aquifer underlies the Mississippian aquifer and consists of limestones and dolomites. Water from this aquifer often has undesirable quantities of naturally-occurring sulfate and dissolved solids; as a result, this aquifer is usually bypassed as a water supply (Buchmiller and others, 1987).

Underlying the Silurian-Devonian aquifer is the Jordan aquifer, which consists of sandstone and dolomite of Ordovician and Cambrian age. The Jordan aquifer is the most extensively used aquifer in Iowa and is the source for many large-capacity water systems. Water from this aquifer contains high concentrations of dissolved solids and is very hard. Radium is also a naturally-occurring constituent in water from some parts of the Jordan aquifer (Buchmiller and others, 1987).

Farms near the Station obtain water from both the shallow glacial aquifers and the Mississippian aquifer. The well nearest the 133rd TCF is approximately 0.75 miles to the southeast. The Station's water is supplied by the City of Fort Dodge from seven wells located within the city limits. These wells range in depth from 541 to 2,307 feet and are probably installed in the Silurian-Devonian and Jordan aquifers.

E. Critical Environments

BASE:

According to the Iowa Department of Natural Resources, there are no federally-listed endangered or threatened species of flora or fauna or other critical environments within a 1-mile radius of the Base. However, a large sand deposit approximately 2 miles south of the Sioux Gateway Airport contains many prairie species of flora, including several listed by the State of Iowa as endangered. Spear grass (Stipa comata) and several types of the prickly pear cactus (Opuntia spp.) are present in this area. Another sand deposit approximately 2 miles west of the airport also contains these species. Within 10 miles of the airport are buffalo grass (Buchloe dactyloides), which is listed as endangered by the State of Iowa, and buffalo berry (Shepherida argentia), which is listed as threatened by the State of Iowa.

STATION:

According to the Iowa Department of Natural Resources, there are no records of federally-listed endangered or threatened species of flora or fauna within a 1-mile radius of the Station. Some State-listed endangered or threatened species may exist near the Des Moines River, which is 1 mile southwest of the Station. No critical habitats, wilderness areas, or other critical environments are within a 1-mile radius of the Station.

IV. SITE EVALUATION

A. Activity Review

BASE:

A review of Base records and interviews with Base personnel resulted in the identification of specific operations at the Base in which the majority of industrial chemicals are handled and hazardous wastes are generated. A total of 27 past and present Base personnel, with an average of 24 years of experience at the Base, were interviewed. These personnel were representative of the following Base shops: Vehicle Maintenance; Aerospace Ground Equipment (AGE) Maintenance; Fire Department; Supply, Petroleum Oils, and Lubricants (POL) Management; Aircraft Maintenance; Flightline; Weapons Maintenance; Corrosion Control; Avionics; Battery Shop; Propulsion Shop; and Civil Engineering. Table 1A provides estimates of the quantities of waste currently being generated by these shops, and describes the past and present disposal practices for the wastes. No records concerning waste disposal practices from 1947 to 1968 were available from the Base. Based on information gathered, any shop that is not listed in Table 1A has been determined to produce negligible quantities of wastes requiring disposal.

STATION:

A review of Station records and interviews with Station personnel resulted in the identification of specific operations at the Station in which the majority of industrial chemicals are handled and hazardous wates are generated. Two Station personnel, with an average of 25 years of experience at the Station, were interviewed. These personnel were representative of the following shops: Vehicle Maintenance; Aerospace Ground Equipment (AGE) Maintenance; Petroleum Oils, and Lubricants (POL) Management; and Battery Shop. Table 1B provides estimates of the quantities of waste currently being generated by these shops, and describes the past and present disposal practices for the wastes. Based on

Table 1A. Hazardous Material/Hazardous Waste Disposal Summary: 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Current Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 — 1960 — 1970 — 1980 — 1988
Aircraft Maintenance (Bldg. No. 261)	PD-680 (Type II) Solvent	300	|---------------DRMO-----------|
	Trichloroethane	10	|---------------DRMO-----------|
	Battery Acid	10	|------------NEUTR SAN---------|
	Carbon Cleaner	30	|---------------DRMO-----------|
	Methyl Ethyl Ketone (MEK)	50	|---------------DRMO-----------|
	Synthetic Turbine Oil	100	|---------------DRMO-----------|
	JP-4 Jet Fuel	200	|---------------FTA------------|
	Sulfuric Acid	3	|------------NEUTR SAN---------|
	Potassium Hydroxide	5	|------------NEUTR SAN---------|
	Mineral Oil	10	|---------------DRMO-----------|
	7808 Oil	30	|---------------DRMO-----------|
	Hydraulic Oil	100	|---------------DRMO-----------|
	Engine Oil	50	|---------------DRMO-----------|
	AVGAS	50	|---------------FTA------------|
	Cleaning Compound	60	|---------------DRMO-----------|

KEY:

CONTR - Disposed of by a contractor.
DRMO - Sent to the Defense Reutilization and Marketing Office.
FTA - Burned at fire training area.
NEUTR SAN - Neutralized and disposed of through sanitary sewer.
OWS - Disposed of through an oil/water separator.
SAN - Disposed of in drains leading to the sanitary sewer.
STORM - Disposed of drains leading to the storm sewer.
TRASH - Disposed of in general refuse.

Table 1A. Hazardous Material/Hazardous Waste Disposal Summary: 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa (Continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Current Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 1960 1970 1980 1988
Aerospace Ground Equipment (AGE) Maintenance (Bldg. No. 234)	Engine Oil	40	1970–1988: DRMO
	Hydraulic Oil	100	1970–1988: DRMO
	Paint Strippers/Thinners	10	1970–1988: DRMO
	JP-4 Jet Fuel	40	1970–1988: FTA
	PD-680 (Type II) Solvent	100	1970–1988: DRMO
	Turbine Oil	10	1970–1988: DRMO
	Motor Oil	50	1970–1988: DRMO
	Gasoline	25	1970–1988: FTA
	Methyl Ethyl Ketone	10	1970–1988: DRMO
	Lubrication Oil	5	1970–1988: DRMO
Fuels Maintenance (Bldg. Nos. 671, 669, 732, and 736)	JP-4 Jet Fuel	30	1970–1988: FTA
	Sulfuric Acid	5	1970–1988: NEUTR SAN
Entomology (Bldg. No. 257)	Pesticides	5	1970–1988: TRASH
	Empty Pesticide Containers	10 ea.	1970–1988: TRASH

KEY:

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FTA - Burned at fire training area.
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OWS - Disposed of through an oil/water separator.
SAN - Disposed of in drains leading to the sanitary sewer.
STORM - Disposed of drains leading to the storm sewer.
TRASH - Disposed of in general refuse.

Table 1A. Hazardous Material/Hazardous Waste Disposal Summary: 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa (Continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Current Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 — 1960 — 1970 — 1980 — 1988
Vehicle Maintenance (Bldg. No. 262)	Engine Oil	220	1970–1988: DRMO
	PD-680 (Type II) Solvent	50	1970–1988: DRMO
	Sulfuric Acid	5	1970–1988: NEUTR SAN
	Ethylene Glycol	100	1970–1988: DRMO
	Hydraulic Oil	60	1970–1988: DRMO
	Transmission Fluid	10	1970–1988: DRMO
	Motor Oil	220	1970–1988: DRMO
	Brake Fluid	4	1970–1988: DRMO
	Diesel Fuel	50	1970–1988: FTA
	Bearing Grease	20 lb.	1970–1988: DRMO
Nondestructive Inspection (NDI) (Bldg. No. 261)	Methyl Ethyl Ketone	2	1970–1988: DRMO
	Methyl Isobutyl Ketone	3	1970–1988: DRMO
	Pentrant	55	1970–1988: DRMO
	Emulsifier	25	1970–1988: NEUTR SAN
	Developer	10	1970–1988: DRMO
	Fixer	10	1970–1988: NEUTR SAN

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SAN - Disposed of in drains leading to the sanitary sewer.
STORM - Disposed of drains leading to the storm sewer.
TRASH - Disposed of in general refuse.

Table 1A. Hazardous Material/Hazardous Waste Disposal Summary: 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa (Continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Current Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 - 1960 - 1970 - 1980 - 1988
Weapons Maintenance (Bldg. No. 232)	Rifle Bore Cleaner	10	1970-1988: TRASH
	Waste Paint	2	1970-1988: TRASH
	Thinners/Lacquers	20	1970-1988: TRASH
	Methyl Ethyl Ketone	5	1970-1988: TRASH
	PD-680 (Type II) Solvent	100	1970-1988: DRMO
	Toluene	2	1970-1988: TRASH
Corrosion Control (Bldg. No. 252)	Paint Strippers	30	1970-1988: DRMO
	Lacquer	5	1970-1988: TRASH
	Acids	150	1970-1988: NEUTR SAN
Paint Shops (Bldg. No. 252)	Solvents	20	1970-1988: DRMO
	Thinners	60	1970-1988: TRASH
	Empty Paint Containers	200 ea.	1970-1988: TRASH
	Methyl Ethyl Ketone	25	1970-1988: DRMO
	Stripper Residue	30	1970-1988: SAN

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SAN - Disposed of in drains leading to the sanitary sewer.
STORM - Disposed of drains leading to the storm sewer.
TRASH - Disposed of in general refuse.

Table 1A. Hazardous Material/Hazardous Waste Disposal Summary: 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa (Continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Current Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950	1960	1970	1980	1988
Machine Shop (Bldg. No. 261)	Metal Cutting Oils	4				DRMO	
	Lubricating Oils	3				DRMO	
Hangar Spaces (Bldg. No. 261)	JP-4 Jet Fuel	50				FTA	
	PD-680 (Type II) Solvent	20				DRMO	
	Methyl Isobutyl Ketone	20				TRASH	
Plumbing Shop (Bldg. No. 255)	Cutting Oil	2				DRMO	
Electric Shop (Bldg. No. 257)	Potassium Hydroxide	5				NEUTR SAN	
Battery Shop (Bldg. No. 252)	Battery Acid	5				NEUTR SAN	
Photo Lab (Bldg. No. 810)	Developer	10				DRMO	
	Fixer	24				NEUTR SAN	
Propulsion Shop (Bldg. No. 235)	PD-680 (Type II) Solvent	300				DRMO	
	Carbon Cleaner	10				DRMO	
	7808 Oil	4				DRMO	

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SAN - Disposed of in drains leading to the sanitary sewer.
STORM - Disposed of drains leading to the storm sewer.
TRASH - Disposed of in general refuse.

Table 1B. Hazardous Material/Hazardous Waste Disposal Summary: 133rd TCF, Iowa Air National Guard, Fort Dodge Municipal Airport, Fort Dodge, Iowa

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Current Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 1960 1970 1980 1988	
Vehicle Maintenance (Bldg. No. 100)	Engine Oil	300	CONTR	185th/DRMO
	Bearing Grease	32 lbs.	TRASH	TRASH
	Ethylene Glycol	300	SAN	185th/DRMO
	Transmission Fluid	55	CONTR	185th/DRMO
	Lubricating Oil	110	CONTR	185th/DRMO
	Hydraulic Oil	110	CONTR	185th/DRMO
	Paint Thinner	55	TRASH	185th/DRMO
	Brake Fluid	20	TRASH	TRASH
	Sulfuric Acid	100	NEUTR SAN	NEUTR SAN
	Hydrochloric Acid	10	NEUTR SAN	NEUTR SAN
	Diesel Fuel	50	185th/FTA	185th/FTA

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FTA - Burned at fire training area.
NEUTR SAN - Neutralized and disposed of through sanitary sewer.
OWS - Disposed of through an oil/water separator.
SAN - Disposed of in drains leading to the sanitary sewer.
TRASH - Disposed of in general refuse.
185th/DRMO - Sent to 185th TFG and then to DRMO.
185th/FTA - Sent to 185th TFG and then burned at fire training area.

Table 1B. Hazardous Material/Hazardous Waste Disposal Summary: 133rd TCF, Iowa Air National Guard, Fort Dodge Municipal Airport, Fort Dodge, Iowa (Continued)

Shop Name and Location	Hazardous Waste/ Used Hazardous Material	Current Estimated Quantities (Gallons/Year)	Method of Treatment/Storage/Disposal 1950 1960 1970 1980 1988
Aerospace Ground Equipment (AGE) Maintenance (Bldg. 101)	JP-4	5	1960–1968: CONTR; 1968–1988: 185th/DRMO
	Engine Oil	50	1960–1968: CONTR; 1968–1988: 185th/DRMO
	7808 Oil	15	1960–1968: CONTR; 1968–1988: 185th/DRMO
	Paint Thinners/Strippers	20	1960–1988: OWS SAN
	Battery Acid	10	1960–1988: NEUTR SAN
Fuels Management (Bldg. No. 100)	Motor gasoline	50	1960–1988: 185th/FTA
	Diesel	100	1960–1988: 185th/FTA
Battery Shop (Bldg. No. 100)	Used Batteries	20 ea.	1960–1988: 185th/DRMO
	Battery Acid	100	1960–1988: NEUTR SAN

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SAN - Disposed of in drains leading to the sanitary sewer.
TRASH - Disposed of in general refuse.
185th/DRMO - Sent to 185th TFG and then to DRMO.
185th/FTA - Sent to 185th TFG and then burned at fire training area.

information gathered, any shop that is not listed in Table 1B has been determined to produce negligible quantities of wastes requiring disposal.

B. Disposal/Spill Site Identification, Evaluation, and Hazard Assessment

BASE:

Interviews with Base personnel and subsequent site inspections resulted in the identification of two sites at the Base that are potentially contaminated with HM/HW. Figure 8 illustrates the locations of the identified sites at the Base.

The two identified sites were assigned a HAS according to HARM (Appendix C). A summary of the HAS for each scored site are listed in Table 2. The Factor Rating Criteria and copies of the completed Hazardous Assessment Rating Forms are included in Appendix D. The objective of this assessment is to provide a relative ranking of sites suspected of contamination from hazardous substances. The final rating score reflects specific components of the hazard posed by a specific site: possible receptors of the contamination (e.g., population within a specified distance of the site and/or critical environments within a 1-mile radius of the site); the waste and its characteristics; and the potential pathways for contaminant migration (e.g., surface water, groundwater, flooding). Descriptions of the sites follow.

Site No. 1 - Defueling Pit (HAS-73)

A defueling pit is located 200 feet north of the alert hangar (Building No. 241) and 100 feet northeast of an old test cell. The pit was used to dump excess JP-4 fuel approximately twice per month during the time the Base had the F-100 aircraft (1961 to 1976). As approximately 500 gallons of JP-4 were drained into the pit during each defueling operation, a total of 180,000 gallons of JP-4 may have been released at this site. At the time of the site visit, the pit was full of water and vegetation around it was stressed. This site was scored on the basis of a "high" hazard, because of

HMTC Source: 185th TFG, Master Plan, 1981.

Figure 8.
Location of Sites at the 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa.

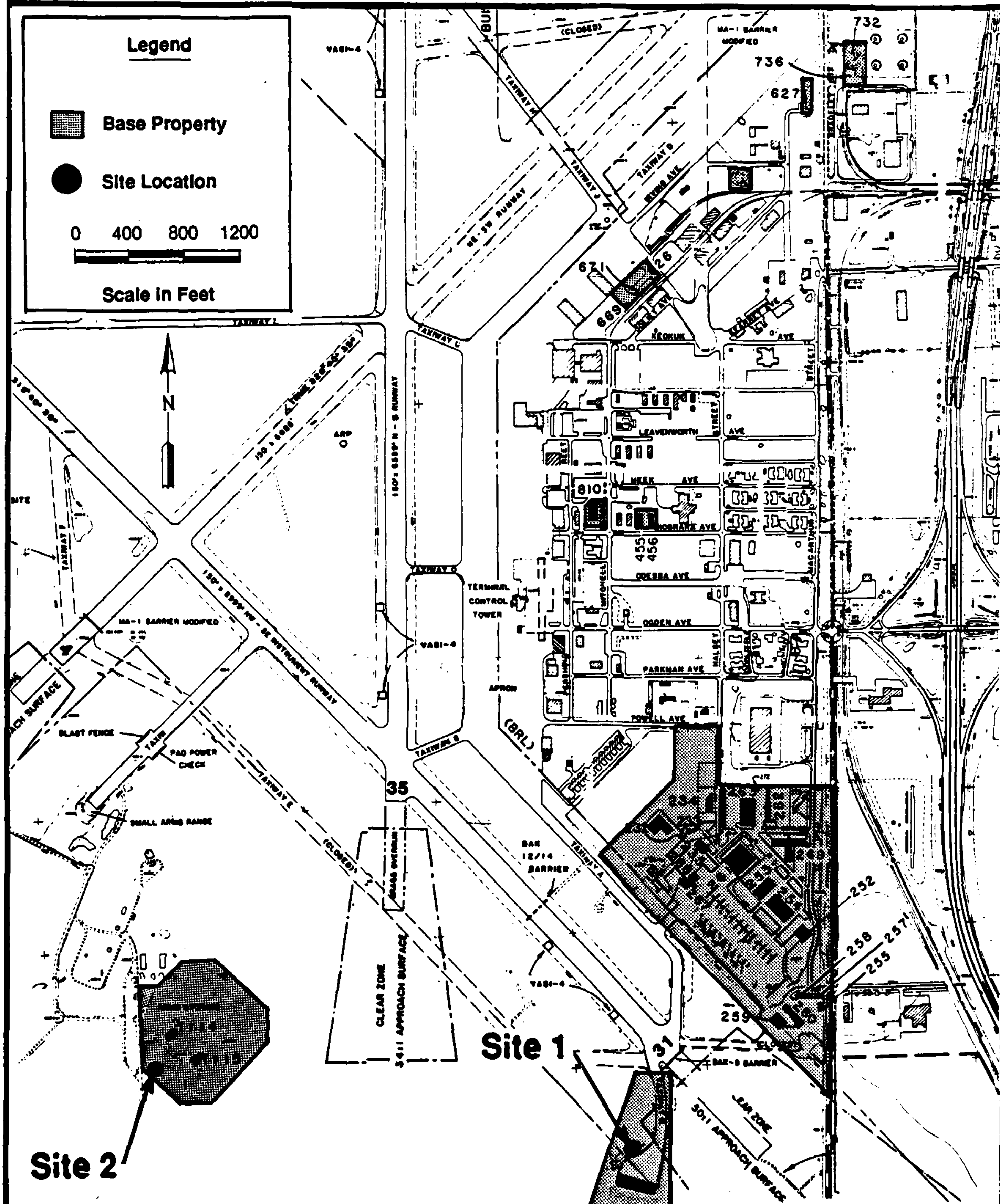


Table 2. Site Hazard Assessment Scores (as Derived from HARM): 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa.

Site Priority	Site No.	Site Description	Receptors	Waste Characteristics	Pathway	Waste Mgmt. Practices	Overall Score
1	1	Defueling Pit	60	80	80	1.0	73
2	2	Possible Low-level Radio-active Waste Disposal Area	54	10	42	0.95	34

the ignitability and toxicity of JP-4, which has a flash point less than 80°F and a Sax's level 3 toxicity.

Site No. 2 - Possible Low-level Radioactive Waste Disposal Area (HAS-34)

Within the ammunition storage area west of the Base is a small area (approximately 10 feet square) enclosed by a dilapidated barbed wire fence. Several padlocked metal cylinders protrude from the ground within the area. It was reported that this area was used by the Air Force for disposal of low-level radioactive wastes, such as radio tubes. No additional information on the amounts or types of wastes disposed of at this site is available. In the past, signs that read "radioactive" were posted on the fence. At the time of the site visit, no radioactivity was detected by a geiger counter in the vicinity of the fenced area; however, readings were not taken inside the cylinders. No other signs of environmental contamination were evident. This site was scored on the basis of a "small" quantity release (less than 5 tons) and radioactivity "one to three times background levels."

STATION:

Interviews with Station personnel and a subsequent facility inspection resulted in the identification of no potentially contaminated sites at the Station. Figure 9 shows the facilities at the Station.

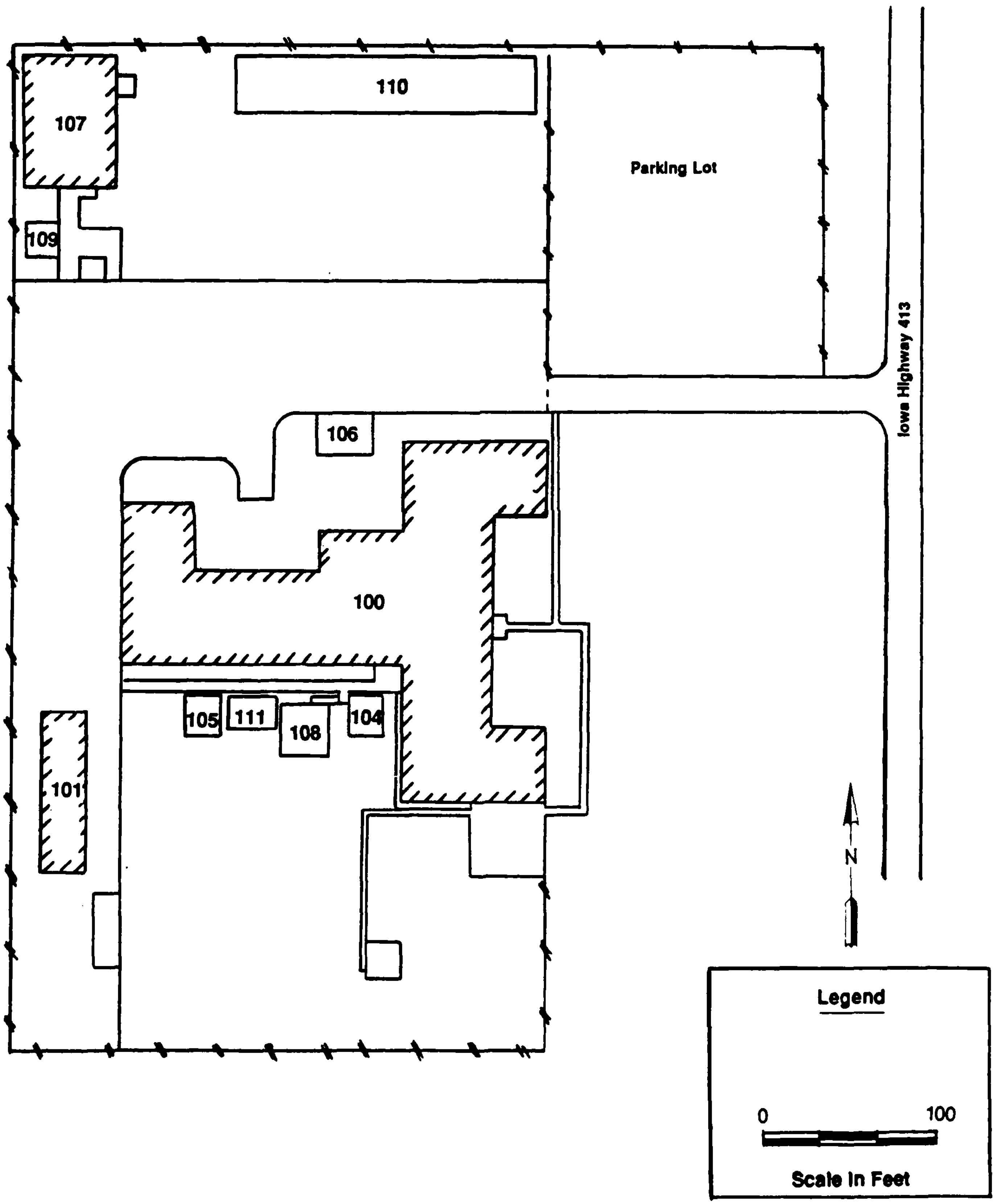
C. Other Pertinent Information

BASE:

- Thirteen underground storage tanks (USTs) were identified at the Base during the Preliminary Assessment, including one abandoned UST behind the old alert hangar (Building No. 241). The locations and characteristics of these USTs are listed in Appendix E.
- No landfills exist on the Base.
- Three fire training areas (FTAs) are located on airport property, immediately adjacent to Taxiway G. These FTAs have been used by both the airport and the Base since approximately 1958. FTA #1 is located

Source: Iowa Air National Guard, 1976.

Figure 9.
Base Map of the 133rd TCF, Iowa Air National Guard, Fort Dodge Municipal Airport, Fort Dodge, Iowa.



northwest of the taxiway and contains a partially-burned F-100 aircraft. FTA #2 is located southeast of the taxiway and contains a burned metal structure. The area surrounding FTA #2 is littered with drums, old tires, oil filters, and other trash. FTA #3 is also located southeast of the taxiway and contains an old school bus. None of the FTAs was diked or had any other containment structure and, at the time of the site visit, each FTA exhibited severe vegetative stress. In the past, aviation gasoline, diesel fuel, waste oil, and waste solvents were burned at the FTAs. In April 1988, the Base assumed full crash, fire, and rescue (CFR) responsibilities for the airport. Prior to that date, the FTAs were under the control of the City of Sioux City. The Base currently holds fire training exercises quarterly, using approximately 500 gallons of JP-4 for each exercise. The FTA is first flooded with water, then the fuel is released on top of the water and burned. In the past year, the Base has also held two additional fire training exercises using 6,000 gallons of No. 1 fuel oil and 700 gallons of gasoline.

- Sanitary sewage from the Base and from the Sioux Gateway Airport is treated at a city-owned, regional sewage treatment plant located approximately 2.8 miles north of the Base. The treated wastewater is discharged to the Missouri River.

- Six oil/water separators (OWSs) are presently in use at the Base; these are located at Building Nos. 252, 261, 258, 1015, 232, and 262. Another OWS, which is located at Building No. 1002, is not in use. The OWSs are connected to the sanitary sewer system. The OWS at Building No. 261, however, has a switchover value to the storm sewer system.

STATION:

- Two USTs were identified at the 133rd TCF. The locations and characteristics of these USTs are also listed in Appendix E.

- No landfills exist on the Station.

- Airport is treated at a sewage treatment plant on airport property. Treated wastewater is discharged to the Des Moines River.

- There is one OWS at the Station, located between Building Nos. 100 and 101.

V. CONCLUSIONS

BASE:

Information obtained through interviews with 27 past and present Base personnel, review of Base records, and field observations has resulted in the identification of two potentially contaminated disposal and/or spill sites on Base property. These sites consist of the following:

Site No. 1 - Defueling Pit (HAS-73)

Site No. 2 - Possible Low-level Radioactive Waste Disposal Area (HAS-34)

Each of these sites is potentially contaminated with HM/HW and each exhibits the potential for contaminant migration to groundwater and surface water. Therefore, these sites were assigned as HAS according to HARM.

STATION:

Information obtained through interviews with two Station personnel, review of Station records, and field observations has resulted in the identification of no potentially contaminated disposal and/or spill sites on Station property.

VI. RECOMMENDATIONS

BASE:

In accordance with applicable regulations, further IRP investigations are recommended for each of the identified sites at the Base.

STATION:

No further IRP investigations are recommended for the Station.

GLOSSARY OF TERMS

ALLUVIAL - Pertaining to or composed of alluvium, or deposited by a stream or running water; e.g., an "alluvial clay" or an "alluvial divide."

ALLUVIAL PLAIN - A level or gently sloping tract or a slightly undulating land surface produced by extensive deposition of alluvium, usually adjacent to a river that periodically overflows its banks.

ALLUVIUM - A general term for clay, silt, sand, gravel, or similar unconsolidated material deposited during comparatively recent geologic time by a stream or running water.

ANNUAL PRECIPITATION - The total amount of rainfall and snowfall for the year.

AQUIFER - A geologic formation, or group of formations, that contains sufficient saturated permeable material to conduct groundwater and to yield economically significant quantities of groundwater to wells and springs.

ARGILLACEOUS - Containing clay-size particles or clay minerals.

BEDROCK - A general term for the rock, usually solid, that underlies soil or other unconsolidated, surficial material.

BLUFF - A high bank or bold headland with a broad, precipitous, sometimes rounded cliff face overlooking a plain or a body of water, especially on the outside of a stream meander.

CALCAREOUS - Said of a substance that contains calcium carbonate.

CAMBRIAN - The earliest period of the Paleozoic era, thought to have covered the span of time between 570 and 500 million years ago.

CENOZOIC - An era of geologic time from the beginning of the Tertiary period (about 65 million years ago) to the present.

CHALKY - Said of a soil or rock consisting of, rich in, or characterized by chalk, a soft, pure, earthy, fine-textured, usually white to light gray or buff limestone of marine origin.

CLAY [soil] - A rock or mineral particle in the soil having a diameter less than 0.002 mm.

CLAY [geol] - A rock or mineral fragment or a detrital particle of any composition smaller than a fine silt grain, having a diameter less than 0.004 mm.

COAL - A readily combustible rock containing more than 50% by weight and more than 70% by volume of carbonaceous material including inherent moisture, formed from compaction and induration of variously altered plant remains similar to those in peat.

CONFINED GROUNDWATER - Groundwater under pressure beneath relatively impermeable rocks or sediment.

CONTAMINANT - As defined by Section 101(f)(33) of Superfund Amendments and Reauthorization Act of 1986 (SARA) shall include, but not be limited to any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformation in such organisms or their offspring; except that the term "contaminant" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under:

(a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,

(b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,

(c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress),

(d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,

(e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and

(f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substance Control Act;

and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

CONTINENTAL CLIMATE - The climate of the interior of a continent, characterized seasonal temperature extremes and by the occurrence of maximum and minimum temperature soon after summer and winter solstice, respectively.

CREEK - A term generally applied to any natural stream of water, normally larger than a brook but smaller than a river.

CRETACEOUS - The final period of the Mesozoic era, thought to have covered the span of time between 135 and 65 million years ago.

CRITICAL HABITAT - The specific areas within the geographical area occupied by

the species on which are found those physical or biological features essential to the conservation of the species and which may require special management consideration or protection.

DEVONIAN - A period of the Paleozoic era (after the Silurian and before the Mississippian), thought to have covered the span of time between 400 and 345 million years ago.

DOLOMITE - A carbonate sedimentary rock of which more than 50% by weight or by areal percentages under the microscope consists of the mineral dolomite, or a variety of limestone or marble rich in magnesium carbonate.

DOLOSTONE - A term proposed by Shrock in 1948 for the sedimentary rock dolomite, in order to avoid confusion with the mineral of the same name.

DRAINAGE NETWORK - The configuration or arrangement of the natural stream courses in an area; it is related to local geologic and geomorphologic features and history.

DRIFT - A general term applied to all rock material (clay, silt, sand, gravel, boulders) transported by a glacier and deposited directly by or from the ice, or by running water emanating from a glacier. Drift includes unstratified material (till) and stratified deposits.

ENDANGERED SPECIES - Any species which is in danger of extinction throughout all or a significant portion of its range, other than a species of the Class Insecta determined by the secretary to constitute a pest whose protection would present an overwhelming and overriding risk to man.

ETHYLENE GLYCOL - A colorless, sweetish alcohol $C_2H_4(OH)_2$, formed by decomposing certain ethylene compounds and used as an antifreeze mixture, lubricant, etc.

FLASH POINT - The lowest temperature at which the vapors of combustable liquids, especially fuels, will ignite.

FLOOD PLAIN - The surface or strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks.

FORMATION - A lithologically distinctive, mappable body of rock.

FOSSILIFEROUS - Containing fossils.

GLACIAL DRIFT - See DRIFT.

GLACIAL TILL - See TILL.

GRAVEL - An unconsolidated, natural accumulation of rounded rock fragments resulting from erosion, consisting predominantly of particles larger than sand, such as boulders, cobbles, pebbles, granules or any combination of these fragments.

GROUND MORAINE - An accumulation of till after it has been deposited or released from the ice during ablation, to form an extensive area of low relief devoid of transverse linear elements.

GROUNDWATER - Refers to the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

GYPSUM - A mineral consisting of hydrous calcium sulfate ($CaS_4 \cdot 02H_2O$) which usually occurs with halite and anhydrite in evaporite deposits.

HARD - Containing certain minerals in solution, especially calcium carbonate. Quality of water that prevents lathering because of calcium and magnesium salts which form insoluble soaps.

HARM - Hazard Assessment Rating Methodology - A system adopted and used by the United States Air Force to develop and maintain a priority listing of potentially contaminated sites on installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts. (Reference: DEQPPM 81-5, 11 December 1981.)

HAS - Hazard Assessment Score - The score developed by using the Hazardous Assessment Rating Methodology (HARM).

HAZARDOUS MATERIAL - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions also found in OSHA and DOT rules.

HAZARDOUS WASTE - A solid or liquid waste that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

a. cause, or significantly contribute to, an increase in mortality or an increase in serious or incapacitating reversible illness, or

b. pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

HYDRAULIC CONDUCTIVITY - The rate at which water can move through a permeable medium.

HYDRAULIC GRADIENT - The difference in head (elevation of water surface) at two points divided by the distance between these two points.

HYDROSTRATIGRAPHIC UNIT - A body of rock having considerable lateral extent and composing a geologic framework for a reasonably distinct hydrologic system.

IGNITABILITY - The ability of a substance to burn or catch fire.

INTERBEDDED - Beds lying between or alternating with others of different character; especially rock material laid down in sequence between other beds.

KETONE - One of a class of organic compounds in which the carbonyl radical unites with two hydrocarbon radicals, i.e. acetone, methyl ethyl ketone.

KNOB-AND-KETTLE TOPOGRAPHY - An undulating landscape in which a disordered assemblage of knolls, mounds, or ridges of glacial drift is interspersed with irregular depressions, pits, or kettles that are commonly undrained and may contain swamps or ponds.

KNOLL - A small, low, rounded hill.

LENS - A geologic deposit bounded by converging surfaces (at least one of which is curved), thick in the middle and thinning out toward the edges, resembling a convex lens. A lens may be double-convex or plano-convex.

LIMESTONE - A sedimentary rock consisting primarily of calcium carbonate, primarily in the form of the mineral calcite.

LOAM - A rich, permeable soil composed of a friable mixture of relatively equal proportions of sand, silt, and clay particles, and usually containing organic matter.

LOESS - A widespread, homogeneous, commonly nonstratified, porous, friable, slightly coherent, usually highly calcareous, fine-grained blanket deposit (generally less than 30 inches thick).

MARINE - Of, pertaining to, or characteristic of the sea.

MARL - A soft, grayish to white, earthy or powdery, usually impure limestone precipitated on the bottom of lakes or ponds.

MEAN ANNUAL LAKE EVAPORATION - The total evaporation amount for a particular area in a year; this amount is based on precipitation and climate (humidity).

MELTWATER - Water derived from the melting of snow or ice, especially the stream flowing in, under, or from melting glacier ice.

MESOZOIC - An era of geologic time, from the end of the Paleozoic to the beginning of the Cenozoic, or from about 225 to about 65 million years ago.

MICACEOUS - Consisting of or containing mica.

MIGRATION (Contaminant) - The movement of contaminants through pathways (groundwater, surface water, soil, and air).

MISSISSIPPIAN - A period of the Paleozoic era (after the Devonian and before the Pennsylvanian) from 345 to 200 million years ago.

MORAINE - A mound, ridge, or other distinct accumulation of unsorted, unstratified glacial drift, predominantly till, deposited chiefly by direct action of glacier ice, in a variety of topographic landforms that are independent of control by the surface on which the drift lies.

MOTTLED - A soil that is irregularly marked with spots or patches of different colors, usually indicating poor aeration or seasonal wetness.

NET PRECIPITATION - Precipitation minus evaporation.

NITRATE - A mineral compound characterized by the fundamental anionic structure of NO_3; a component of fertilizers.

ORDOVICIAN - The second earliest period of the Paleozoic era (after the Cambrian and before the Silurian).

OUTWASH - A stratified detritus (chiefly sand and gravel) removed or "washed out" from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of an active glacier.

OUTWASH PLAIN - A broad, gently sloping sheet of outwash deposited by meltwater streams flowing in front of or beyond a glacier, and formed by coalescing outwash fans.

PALEOZOIC - An era of geologic time, from the end of the Precambrian to the beginning of the Mesozoic, or from 570 to about 225 million years ago.

PD-680 - A cleaning solvent composed predominately of mineral spirits; Stoddard solvent.

PENNSYLVANIAN - A period of the Paleozoic era (after the Mississippian and before the Permian), thought to have covered the span of time between 320 and 280 million years ago; also, the corresponding worldwide system of rocks.

PERMIAN - The last period of the Paleozoic era (after the Pennsylvanian) from 280 to 225 million years ago.

PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

PESTICIDE - A chemical or other substance used to destroy plant and animal pests.

PHYSIOGRAPHIC PROVINCE - Region of similar structure and climate that has had a unified geomorphic history.

PLEISTOCENE - The first epoch of the Quaternary period; the Pleistocene began two to three million years ago and lasted until the start of the Holocene period some 8,000 years ago.

POND - A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger then a pool.

POTENTIOMETRIC SURFACE - An imaginary surface defined by the level to which water will rise in wells.

PRAIRIE - Level to rolling grassland, generally treeless, in the temperate latitudes of the interior of North America; characterized by a deep, fertile soil and by a covering of tall, coarse grass and herbaceous plants.

PRECAMBRIAN - All geologic time, and its corresponding rocks, before the beginning of the Paleozoic; it is equivalent to about 90% of geologic time.

QUATERNARY - The second period of the Cenozoic era, following the Tertiary: it began 3 to 2 million years ago and extends to the present.

RADIOACTIVITY - Spontaneous nuclear disintegration of certain elements and isotopes, with the emission of radiation, radiant energy capable of affecting living tissue.

RADIUM - A powerfully radioactive metallic element, obtained principally as a disintigration product of the uranium series.

RANGE - Any series of contiguous *townships* aligned north and south and numbered consecutively east and west from a principal meridian (e.g. range 4 east). See SECTION, TOWNSHIP.

RIVER - A general term for a natural freshwater surface stream of considerable volume and a permanent or seasonal flow, moving in a definite channel toward a sea, lake, or another river.

SAND - A rock or mineral particle in the soil, having a diameter in the range 0.52 to 2 mm.

SANDSTONE - A medium-grained fragmented sedimentary rock composed of abundant round or angular fragments of sand, size set in a fine-grained matrix (silt or clay) and more or less firmly united by a cementing material (commonly silica, iron oxide, or calcium carbonate).

SECTION - One of the 36 units of a subdivision of a *township*, representing a piece of land one mile square. See RANGE, TOWNSHIP.

SEDIMENT - Solid fragmental material that originates from weathering of rocks and is transported or deposited by air, water, or ice, or that accumulates by other natural agents, such as chemical precipitation from solution or secretion by organisms, and that forms in layers on the Earth's surface at ordinary temperatures in a loose, unconsolidated form; (b) strictly solid material that has settled down from a state of suspension in a liquid.

SEDIMENTARY ROCK - A rock resulting in the consolidation of loose sediment that has accumulated in layers; e.g., a clastic rock (such as conglomerate or tillite) consisting of mechanically formed fragments of older rock transported from its source and deposited in water or from air or ice; or a chemical rock (such as rock salt or gypsum) formed by precipitation from solution; or an organic rock (such as certain limestones) consisting of the remains or secretions of plants and animals.

SELENITE - The clear, colorless variety of gypsum, occurring (especially in clays) in distinct, transparent monoclinic crystals.

SHALE - A fine-grained detrital sedimentary rock, formed by the consolidation (especially by compression) of clay, silt, or mud.

SHALY - Pertaining to, composed of, or having the character of shale.

SILT [soil] - (a) A rock or mineral particle in the soil, having a diameter in the range of 0.002 to 0.005 mm; (b) A soil containing more than 80% silt-size particles, less than 12% clay, and less than 20%.

SILT [geol] - A rock fragment or detrital particle smaller than a very fine sand grain and larger than coarse clay, having a diameter in the range of 0.004 to 0.063 mm.

SILT LOAM - A soil containing 50 - 88% silt, 0 - 27% clay and 0 - 50% sand.

SILTSTONE - A rock whose composition is intermediate between those of sandstone and shale and of which at least two-thirds is material of silt size.

SILTY CLAY - A soil containing 40-60% clay, 40-60% silt, and less than 20% sand.

SILTY CLAY LOAM - A soil containing 27-40% clay, 60-73% silt and less than 20% sand.

SLOPE - (a) Gradient; (b) The inclined surface of any part of the Earth's surface.

SOIL PERMEABILITY - The characteristic of the soil that enables water to move downward through the profile. Permeability is measured as to the number of inches per hour that water moves downward through the saturated soil.

Terms describing permeability are:

Very Slow	- less than 0.06 inches per hour (less than 4.24×10^{-5} cm/sec)
Slow	- 0.06 to 0.20 inches per hour (4.24×10^{-5} to 1.41×10^{-4} cm/sec)
Moderately Slow	- 0.20 to 0.63 inches per hour (1.41×10^{-4} to 4.45×10^{-4} cm/sec)/
Moderate	- 0.63 to 2.00 inches per hour (4.45×10^{-4} to 1.41×10^{-3} cm/sec)
Moderately Rapid	- 2.00 to 6.00 inches per hour (1.41×10^{-3} to 4.24×10^{-3} cm/sec)
Rapid	- 6.00 to 20.00 inches per hour (4.24×10^{-3} to 1.41×10^{-2} cm/sec)
Very Rapid	- more than 20.00 inches per hour (more than 1.41×10^{-2} cm/sec)

(Reference: U.S.D.A. Soil Conservation Service)

SOIL REACTION - The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests at pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

SOIL STRUCTURE - The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil sturcture are -- platty (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

SOLVENT - A substance, generally a liquid, capable of dissolving other substances.

STRATA - Distinguishable horizontal rock layers separated vertically from other layers.

STRATIFIED - Formed, arranged, or laid down in layers or strata.

STRATIGRAPHIC UNIT - A stratum or body of adjacent strata recognized as a unit in the classification of a rock sequence.

SURFACE WATER - All water exposed at the ground surface, including streams, rivers, ponds, and lakes.

SWALE - A shallow depression, sometimes swampy, in the midst of generally level land or in an undulating ground moraine due to uneven glacial deposition.

THREATENED SPECIES - Any species which is likely to become an endangered species within the foreseeable future throughout all or significant portion of its range.

TILL - Dominantly unsorted and unstratified drift, generally unconsolidated, deposited directly by and underneath a glacier without subsequent reworking by meltwater, and consisting of a heterogenous mixture of clay, silt, sand and gravel and boulders ranging widely in size and shape

TOPOGRAPHY - The general conformation of a land surface, including its relief and the position of its natural and manmade features.

TOWNSHIP - The unit of survey of the U.S. Public Land Survey, representing a piece of land that is bounded on the east and west by meridians approximately 6 miles apart and on the north and south by parallels six miles apart, and that is normally divided into 36 *sections*. Townships are located with references to a principal meridian and base line, and are normally numbered consecutively north and south from the base line (e.g. "township 14 north"). Used in conjunction with *range*.

TOXICITY - The degree of intensity of a poison; toxicity can be evaluated using the rating scheme of Sax (1984):

0 = no toxicity (None)
Substances that cause no harm under any conditions or substances that cause toxic effects under the most unusual conditions or by overwhelming doses.
1 = slight toxicity (Low)
Substances that produce changes in the human body which are readily reversible and which will disappear following termination of exposure.
2 = moderate toxicity (Moderate)
Substances that may produce irreversible as well as reversible changes in the human body. These changes are not of such severity as to threaten life or to produce serious physical impairment.
3 = severe toxicity (High)
Substances that produce irreversible changes in the human body. These changes are of such severity to threaten human life or cause death.

TRIBUTARY - A stream feeding, joining, or flowing into a larger stream or into a lake.

UNCONFINED GROUNDWATER - Groundwater that has a free water table, i.e., water not confined under pressure beneath relatively impermeable rocks.

UNCONFORMABLE - Said of strata or stratification exhibiting the relation of unconformity to the older underlying rocks.

UNCONFORMITY - A substantial break or gap in the geologic record where a rock unit is overlain by another that is not next in stratigraphic succession, such as an interruption in the continuity of a depositional sequence of sedimentary rocks or a break between eroded igneous rocks and younger sedimentary strata.

UNCONSOLIDATED MATERIAL - A sediment that is loosely arranged or whose particles are not cemented together, occuring either at the surface or at depth.

WATER TABLE - The upper limit of the portion of the ground that is wholly saturated with water.

WETLANDS - Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life

in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

WILDERNESS AREA - An area unaffected by anthropogenic activities and deemed worthy of special attention to maintain its natural condition.

WISCONSINAN - Pertaining to the classical fourth glacial stage of Pleistocene epoch in North America.

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APPENDIX A

Resumes of HMTC Preliminary Assessment Team

JANET SALYER EMRY

EDUCATION

M.S., geology, Old Dominion University, 1987
B.S. (cum laude), geology, James Madison University, 1983

EXPERIENCE

Three years' technical experience in the fields of hydrogeology and environmental science, including drilling and placement of wells, well monitoring, aquifer testing, determination of hydraulic properties, computer modeling of aquifer systems, and field and laboratory soils analysis.

EMPLOYMENT

Dynamac Corporation (1987-present): Staff Scientist/Hydrogeologist

Responsibilities include Preliminary Assessments, Site Investigations, Remedial Investigations, Feasibility Studies, and Emergency Responses to include providing geological and hydrological assessments of hazardous waste disposal/spill sites, determination of rates and extents of contaminant migration, and computer modeling of groundwater flow and contaminant transport. Projects are for the U.S. Air Force and Air National Guard Installation Restoration Program.

Froehling and Robertson, Inc. (1986-1987): Geologist/Engineering Technician

Performed both field and laboratory engineering soils tests.

The Nature Conservancy (1985-1986): Hydrogeologist

Investigated groundwater geology of the Nature Conservancy's Nags Head Woods Ecological Preserve in Dare County, North Carolina. Study included installing wells, monitoring water table levels, determination of hydraulic parameters through a pumping test, stratigraphic test borings, and computer modeling.

Old Dominion University (1983-1985): Teaching Assistant, Department of Geological Sciences

Taught laboratory classes in Earth Science and Historical Geology.

PROFESSIONAL AFFILIATIONS

Geological Society of America
National Water Well Association/Association of Ground Water Scientists and Engineers

PUBLICATION

Impact of Municipal Pumpage Upon a Barrier Island Water Table, Nags Head and Kill Devil Hills, North Carolina. In: Abstracts with Programs, Geological Society of America, Vol. 19, No. 2, February 1987.

RAYMOND G. CLARK, JR.

EDUCATION

Completed graduate engineering courses, George Washington University, 1957
B.S., Mechanical Engineering, University of Maryland, 1949

SPECIALIZED TRAINING

Grad. European Command Military Assistance School, Stuttgart, 1969
Grad. Army Psychological Warfare School, Fort Bragg, 1963
Grad. Sanz School of Languages, D.C., 1963
Grad. DOD Military Assistance Institute, Arlington, 1963
Grad. Defense Procurement Management Course, Fort Lee, 1960
Grad. Engineer Officer's Advanced Course, Fort Belvoir, 1958

CERTIFICATIONS

Registered Professional Engineer: Kentucky (#4341); Virginia (#8303); Florida (#36228)

EXPERIENCE

Thirty-one years of experience in engineering design, planning and management including construction and construction management, environmental, operations and maintenance, repair and utilities, research and development, electrical, mechanical, master planning and city management. Over six years' logistical experience including planning and programming of military assistance materiel and training for foreign countries, serving as liaison with American private industry, and directing materiel storage activities in an overseas area. Over two years' experience as an engineering instructor. Extensive experience in personnel management, cost reduction programs, and systems improvement.

EMPLOYMENT

Dynamac Corporation (1986-present): Program Manager/Department Manager

Responsible for activities relating to Preliminary Analysis, Site Investigations, Remedial Investigations, Feasibility Studies, and Remedial Action for the Installation Restoration Program for the U.S. Air Force, Air National Guard, Bureau of Prisons, and the U.S. Coast Guard, including records search, review and evaluation of previous studies; preparation of statements of work, feasibility studies; preparation of remedial action plans, designs and specifications; review of said studies/plans to ensure that they are in conformance with requirements; review of environmental studies and reports; preparation of Air Force Installation Restoration Program Management Guidance; and preparation of Part B permits.

Howard Needles Tammen & Bergendoff (HNTB) (1981-1986): Manager

Responsible, as Project Manager, for: design of a new concourse complex at Miami International Airport to include terminal building, roadway system, aircraft apron, drainage channel relocation, satellite building with underground pedestrian tunnel, and associated underground utility corridors, to include subsurface aircraft fueling systems, with an estimated construction cost of $163 million; a cargo vehicle tunnel under the crosswind runway with an estimated construction cost of $15 million; design and construction of two large corporate jet aircraft hangars; and for the hydrocarbon recovery program to include investigation, analysis, design of recovery systems, monitoring of recovery systems, and planning and design of residual recovery systems utilizing biodegradation. Participated, as sub-consultant, in Air Force IRP seminar.

HNTB (1979-1981): Airport Engineer

Responsibilities included development of master plan for Iowa Air National Guard base; project initiation assistance for a new regional airport in Florida; engineering assistance for new facilities design and construction for Maryland Air National Guard; master plan for city maintenance facilities, Orlando, Florida; in-country master plan and preliminary engineering project management for Madrid, Spain, International Airport; and project management of master plan for Whiting Naval Air Station and outlying fields in Florida.

HNTB (1974-1979): Design Engineer

Responsibilities included development of feasibility and site selection studies for reliever airports in Cleveland and Atlanta; site selection and facilities requirements for the Office of Aeronautical Charting and Cartography, NOAA; and onsite mechanical and electrical engineering design for terminal improvements at Baltimore-Washington International Airport, Maryland.

HNTB (1972-1974): Airport Engineer

Responsible for development of portions of the master plan and preliminary engineering for a new international airport for Lisbon, Portugal, estimated to cost $250 million.

Self-employed (1971-1972): Private Consultant

Responsible for engineering planning and installation of a production line for multimillion-dollar contract in Madrid, Spain, to fabricate transmissions and differentials for U.S. Army vehicles.

U.S. Army, Corps of Engineers (1969-1971): Chief, Materiel & Programs

Directed materiel planning and military training programs of military assistance to the Spanish Army. Controlled arrival and acceptance of materiel by host government. Served as liaison/advisor to American industry interested

in conducting business with Spanish government. Was Engineer Advisor to Spanish Army Construction, Armament and Combat Engineers, also the Engineer Academy and Engineer School of Application.

Corps of Engineers (1968-1969): Chief, R&D Branch, OCE

Directed office responsible to Chief of Engineers for research and development. Developed research studies in new concepts of bridging, new explosives, family of construction equipment, night vision equipment, expedient airfield surfacing, expedient aircraft fueling systems, water purification equipment and policies, prefabricated buildings, etc. Achieved Department of Army acceptance for development and testing of new floating bridge. Participated in high-level Department Committee charged with development of a Tactical Gap Crossing Capability Model.

Corps of Engineers (1967-1968): Division Engineer

Facilities engineer in Korea. Was fully responsible for management and maintenance of 96 compounds within 245 square miles including 6,000+ buildings, 1 million linear feet of electrical distribution lines, 18 water purification and distribution systems, sanitary sewage disposal systems, roads, bridges, and fire protection facilities with real property value of more than $256 million. Planned and developed the first five-year master plan for this area. Administered $12 million budget and $2 million engineer supply operation. Was in responsible charge of over 500 persons. Developed and obtained approval for additional projects worth $9 million for essential maintenance and repair. Directed cost reduction programs that produced more than $500,000 savings to the United States in the first year.

Corps of Engineers (1963-1967): Engineer Advisor

Engineer and aviation advisor to the Spanish Army. Developed major modernization program for Spanish Army Engineers, including programming of modern engineer and mobile maintenance equipment. Directed U.S. portion of construction, testing and acceptance of six powder plants, one shell loading facility, an Engineer School of Application, and depot rebuild facilities for engineer, artillery, and armor equipment. Planned and developed organization of a helicopter battalion for the Spanish Army. Responsible for sales, delivery, assembly and testing of 12 new helicopters in country. Provided U.S. assistance to unit until self-sufficiency was achieved. Was U.S. advisor to Engineer Academy, School of Application and Polytechnic Institute.

Corps of Engineers (1960-1963): Deputy District Engineer

Responsible for planning and development of extensive construction projects in the Ohio River Basin for flood control and canalization, including dam, lock, bridge, and building construction, highway relocation, watershed studies, real estate acquisitions and dispositions. Was contracting officer for more than $75

million of projects per year. Supervised approximately 1,300 personnel, including 300 engineers. Planned and directed cost reduction programs amounting to more than $200,000 per year. Programmed and controlled development of a modern radio and control net in a four-state area.

Corps of Engineers (1959-1960): Area Engineer

Directed construction of a large airfield in Ohio as Contracting Officer's representative. Assured that all construction (runway, steam power plant, fuel transfer and loading facilities, utilities, buildings, etc.) complied with terms of plans and specifications. Was onsite liaison between Air Force and contractors.

Corps of Engineers (1958-1959): Chief, Supply Branch

Managed engineer supply yard containing over $21 million construction supplies and engineer equipment. Directed in-storage maintenance, processing and deprocessing of equipment. Achieved complete survey of items on hand, a new locator system and complete rewarehousing, resulting in approximately $159,000 savings in the first year.

Corps of Engineers (1957-1958): Student

U.S. Army Engineer School, Engineer Officer's Advanced Course.

Corps of Engineers (1954-1957): Engineer Manager

Managed engineer construction projects and was assigned to staff and faculty of the Engineer School. Was in charge of instruction on engineer equipment utilization, management and maintenance. Directed Electronic Section of the school. Coordinated preparation of five-year master plan for the Department of Mechanical and Technical Equipment.

Corps of Engineers (1949-1954): Engineer Commander

Positions of minor but increasing importance and responsibility in engineering management, communications, demolitions, construction administration and logistics.

PROFESSIONAL AFFILIATIONS

Member, National Society of Professional Engineers
Fellow, Society of American Military Engineers
Member, American Society of Civil Engineers
Member, Virginia Engineering Society
Member, Project Management Institute

MARK D. JOHNSON

EDUCATION

B.S., Geology, James Madison University, 1980

EXPERIENCE

Eight years' technical and management experience including geologic mapping, subsurface investigations, foundation inspections, groundwater monitoring, pumping and observation well installation, geotechnical instrumentation, groundwater assessment, preparation of Air Force Installation Restoration Program Guidance, preparation of statements of work for environmental field monitoring and feasibility studies for the Air Force and the Air National Guard, development of environmental field monitoring programs, and preparation of Preliminary Assessments for the Air National Guard.

EMPLOYMENT

Dynamac Corporation (1984-present): Senior Staff Scientist/Geologist

Primarily responsible for developing and managing technical support programs relevant to CERCLA related activities for the Air Force, Air National Guard, Department of Justice and Coast Guard. These activities include Statements of Work for Site Investigations (SI), Remedial Investigations (RI), and Feasibility Studies (FS); assessing groundwater at hazardous waste disposal/spill sites for the purpose of determining rates and extents of contaminant migration and for developing SI and RI programs and identifying remedial actions; reviewing SI, RI and FS contractor work plans for various government clients, developing technical and contractual requirements for SI, RI and FS projects, managing the development and preparation of Preliminary Assessments, and assisting clients in the development of their environmental management programs, which included preparation of the Air Force's Installation Restoration Program Management Guidance document.

Bechtel Associates Professional Corporation (1981-1984): Geologist

Performed the following duties in conjunction with major civil engineering projects including subways, nuclear power plants and buildings: prepared geologic maps of surface and subsurface facilities in rock and soil including tunnels, foundations and vaults; assessed groundwater conditions in connection with construction activities and groundwater control systems; monitored the installation of permanent and temporary dewatering systems and observation wells; monitored surface and subsurface settlement of tunnels; and participated in subsurface investigations.

Schnabel Engineering Associates (1981): Geologist

Inspected foundations and backfill placement.

PROFESSIONAL CREDENTIALS

Registered Professional Geologist, South Carolina, #116, 1987

PROFESSIONAL AFFILIATIONS

Association of Engineering Geologists
National Water Well Association/Association of Ground Water Scientists and Engineers

APPENDIX B

Outside Agency Contact List

OUTSIDE AGENCY CONTACT LIST

Iowa Department of Natural Resources
Wallace State Office Building
Des Moines, IA 50319-0034

National Oceanic and Atmospheric Administration
Sioux Gateway Airport
Sergeant Bluff, IA 51054

U.S. Geological Survey
12201 Sunrise Valley Drive
Reston, VA 22092

U.S. Soil Conservation Service
U.S. Department of Agriculture
Washington, DC 20250

APPENDIX C

U.S. Air Force Hazard Assessment Rating Methodology and Guidelines

USAF HAZARD ASSESSMENT RATING METHODOLOGY

The Department of Defense (DoD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DoD facilities. One of the actions required under this program is to:

> develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Preliminary Assessment phase of its Installation Restoration Program (IRP).

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air National Guard in setting priorities for follow-on site investigations.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DoD program needs.

The model uses data readily obtained during the Preliminary Assessment portion of the IRP. Scoring judgment and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards. This approach meshes well with the policy for evaluating and setting restrictions on excess DoD properties.

Site scores are developed using the appropriate ranking factors according to the method presented in the flow chart (Figure 1 of this report). The site rating form and the rating factor guideline are provided at the end of this appendix.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: possible receptors of the contamination, the waste and its characteristics, the potential pathways for contaminant migration, and any efforts that were made to contain the wastes resulting from a spill.

The receptors category rating is based on four rating factors: the potential for human exposure to the site, the potential for human ingestion of contaminants should underlying aquifers be polluted, the current and anticipated uses of the surrounding area, and the potential for adverse effects upon important biological resources and fragile natural settings. The potential for human exposure is evaluated on the basis of the total population within 1,000 feet of the site, and the distance between the site the the base boundary. The potential for human ingestion of contaminants is based on the distance between the site and the nearest well, the groundwater use of the uppermost aquifer, and population served by the groundwater supply within 3 miles of the site. The uses of the surrounding area are determined by the zoning within a 1-mile radius. Determination of whether or not critical environments exist within a 1-mile radius of the site predicts the potential for adverse effects from the site upon important biological resources and fragile natural settings. Each rating factor is numerically evaluated (0-3) and increased by a multiplier. The maximum possible score is also computed. The factor score and maximum possible scores are totaled, and the receptors subscore computed as follows: receptors subscore = (100 x factor score subtotal/maximum score subtotal).

The waste characteristics category is scored in three stages. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways: surface-water migration, flooding, and groundwater migration. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned, and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among the three possible routes is used. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The scores for each of the three categories are added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Scores for sites with no containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1-mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence or economically important natural resources susceptible to contamination	Major habitat of an endangered or threatened species; presence of recharge area major wetlands	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use	Recreation, propagation and management of fish and wildlife	Shellfish propagation and harvesting	Potable water supplies	6
G. Ground-water use of uppermost aquifer	Not used, other sources readily available	Commercial, industrial, or irrigation, very limited other water sources	Drinking water, municipal water available	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1-50	51-1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	Greater than 1,000	6

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

o Verbal reports from interviewer (at least 2) or written information from the records

o Knowledge of types and quantities of wastes generated by shops and other areas on base

S = Suspected confidence level

o No verbal reports or conflicting verbal reports and no written information from the records

Logic based on the knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site

A-3 Hazard Rating

Rating Factors	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200° F	Flash point at 140° F to 200° F	Flash point at 80° F to 140° F	Flash point less than 80° F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

II. WASTE CHARACTERISTICS -Continued

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:

For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

Confidence Level

- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

Waste Hazard Rating

- o Wastes with the same hazard rating can be added.
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 Potential for Surface Water Contamination

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (including drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1-year 24-hour rainfall (Number of thunderstorms)	<1.0 inch (0-5)	1.0 to 2.0 inches (6-35)	2.1 to 3.0 inches (36-49)	>3.0 inches (>50)	8

B-2 Potential for Flooding

Rating Factors	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1

B-3 Potential for Ground Water Contamination

Rating Factors	0	1	2	3	Multiplier
Depth to groundwater	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	8
Soil permeability	Greater than 50% clay ($<10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($>10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground water level	8

B 3 <u>Potential for Ground Water Contamination</u> Continued

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
Direct access to groundwater (through faults, fractures, faulty well casings, subsidence, fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. Waste Management Practices Factor

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Fire Protection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1, or III 6-3, then leave blank for calcul tion of factor score and maximum possible score.

APPENDIX D

Hazard Assessment Rating Methodology
Factor Rating Criteria and
Hazardous Assessment Rating Forms

185th Tactical Fighter Group
Iowa Air National Guard
Sioux Gateway Airport
Sergeant Bluff, Iowa

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

1. RECEPTORS CATEGORY	RATING SCALE LEVELS	NUMERICAL VALUE
Population within 1,000 feet of site:		
Site No. 1	None	0
Site No. 2	None	0
Distance to nearest well:		
Site No. 1	2,000 feet	3
Site No. 2	3,400 feet	2
Land use/zoning within 1 mile radius:	Residential	3
Distance to Base boundary:		
Site No. 1	Less than 100 feet	3
Site No. 2	Less than 200 feet	3
Critical environments within 1 mile:	Not a critical environment	0
Water quality of nearest surface water body:	Recreation	1
Groundwater use of uppermost aquifer:	Drinking water, no municipal water available	3
Population served by surface water supply within 3 miles downstream of site:	None	0
Population served by groundwater supply within 3 miles of site:	Greater than 1,000	3

185th Tactical Fighter Group
Iowa Air National Guard
Sioux Gateway Airport
Sergeant Bluff, Iowa

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

2. WASTE CHARACTERISTICS CATEGORY	RATING SCALE LEVELS	NUMERICAL VALUE
Quantity:		
Site No. 1	Up to 180,000 gallons	L
Site No. 2	Less than 5 tons	S
Confidence Level:		
Site No. 1	Confirmed	C
Site No. 2	Suspected	S
Hazard Rating:		
Toxicity		
Site No. 1	Sax's Level 3	3
Site No. 2	Sax's Level 0	0
Ignitability		
Site No. 1	Flash point less than 80°F	3
Site No. 2	Flash point greater than 200°F	0
Radioactivity		
Site No. 1	At or below background levels	0
Site No. 2	One to three times background levels	1
Persistance Multiplier:		
Site No. 1	Straight chain hydrocarbons	0.8
Site No. 2	Metals	1.0
Physical State Multiplier:		
Site No. 1	Liquid	1.0
Site No. 2	Solid	0.5

Iowa Air National Guard
Sioux Gateway Airport
Sergeant Bluff, Iowa

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

3. PATHWAYS CATEGORY	RATING SCALE LEVELS	NUMERICAL VALUE
Surface Water Migration:		
Distance to nearest surface water		
Site No. 1	1.9 miles	0
Site No. 2	1.25 miles	0
Net precipitation	Negative 13 inches/year	0
Surface erosion	None	0
Surface permeability		
Site No. 1	less than 1.41×10^{-5} cm/sec	2
Site No. 2	4.45×10^{-4} to 1.41×10^{-3} cm/sec	1
Rainfall intensity	2.6 inches	2
Flooding:	Not within a 100-year floodplain	0
Groundwater Migration:		
Depth to groundwater	11 to 50 feet	2
Net precipitation	Negative 13 inches/year	0
Soil permeability		
Site No. 1	less than 1.41×10^{-5} cm/sec	1
Site No. 2	4.45×10^{-4} to 1.41×10^{-3} cm/sec	2
Subsurface flow	Bottom of site frequently submerged	2
Direct access to groundwater	No evidence of risk	0

185th Tactical Fighter Group
Iowa Air National Guard
Sioux Gateway Airport
Sergeant Bluff, Iowa

USAF Hazard Assessment Rating Methodology
Factor Rating Criteria

4. WASTE MANAGEMENT PRACTICES CATEGORY	RATING SCALE LEVELS	NUMERICAL VALUE
Practice:		
Site No. 1	No containment	1.0
Site No. 2	Limited containment	0.95

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE	DEFUELING PIT (SITE 1)
LOCATION	IOWA AIR NATIONAL GUARD, SIOUX CITY, IOWA
DATE OF OPERATION/OCCURRENCE	1961 TO 1976
OWNER/OPERATOR	185TH TFG
COMMENTS/DESCRIPTION	
RATED BY	HMTC

I. RECEPTORS

RATING FACTOR		FACTOR RATING	MULTIPLIER	FACTOR SCORE	MAXIMUM POSSIBLE SCORE
A. POPULATION WITHIN 1000 FEET OF SITE	:	0	4	0	12
B. DISTANCE TO NEAREST WELL	:	3	10	30	30
C. LAND USE/ZONING WITHIN 1 MILE RADIUS	:	3	3	9	9
D. DISTANCE TO INSTALLATION BOUNDARY	:	3	6	18	18
E. CRITICAL ENVIRONMENTS WITHIN 1 MILE RADIUS OF SITE	:	0	10	0	30
F. WATER QUALITY OF NEAREST SURFACE WATER	:	1	6	6	18
G. GROUND WATER USE OF UPPERMOST AQUIFER	:	3	9	27	27
H. POPULATION (WITHIN 3 MILES) SERVED BY					
DOWN STREAM SURFACE WATER	:	0	6	0	18
GROUND WATER	:	3	6	18	18
		SUBTOTALS		108	180

RECEPTORS SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL) 60

II. WASTE CHARACTERISTICS

A. SELECT THE FACTOR SCORE BASED ON THE ESTIMATED QUANTITY, THE DEGREE OF HAZARD, AND THE CONFIDENCE LEVEL OF THE INFORMATION.

1. WASTE QUANTITY (S=SMALL, M=MEDIUM, L=LARGE) (L)
2. CONFIDENCE LEVEL (S=SUSPECT, C=CONFIRM) (C)
3. HAZARD RATING (L=LOW, M=MEDIUM, H=HIGH) (H)

FACTOR SUBSCORE A (100)
(FROM 20 TO 100 BASED ON FACTOR SCORE MATRIX)

B. APPLY PERSISTENCE FACTOR

FACTOR SUBSCORE A x PERSISTENCE FACTOR = SUBSCORE B
(100)(0.8) = (80)

C. APPLY PHYSICAL STATE MULTIPLIER

SUBSCORE B x PHYSICAL STATE MULTIPLIER = WASTE CHARACTERISTICS SUBSCORE
(80)(1) = (80)

III. PATHWAY

RATING FACTOR		FACTOR RATING	MULTIPLIER	FACTOR SCORE	MAXIMUM POSSIBLE SCORE

A. IF THERE IS EVIDENCE OF MIGRATION OF HAZARDOUS CONTAMINANTS, ASSIGN MAXIMUM FACTOR SUBSCORE OF (100 POINTS FOR DIRECT EVIDENCE) OR (80 POINTS FOR INDIRECT EVIDENCE). IF DIRECT EVIDENCE (100) EXISTS THEN PROCEED TO C. IF NO EVIDENCE OR INDIRECT EVIDENCE (80 OR LESS) EXISTS, PROCEED TO B.

(80)

B. RATE THE MIGRATION POTENTIAL FOR 3 POTENTIAL PATHWAYS: SURFACE WATER MIGRATION, FLOODING, AND GROUND-WATER MIGRATION. SELECT THE HIGHEST RATING, AND PROCEED TO C.

1. SURFACE WATER MIGRATION

DISTANCE TO NEAREST SURFACE WATER	:	0	8	0	24
NET PRECIPITATION	:	0	6	0	18
SURFACE EROSION	:	0	8	0	24
SURFACE PERMEABILITY	:	2	6	12	18
RAINFALL INTENSITY	:	2	8	16	24
SUBTOTALS				28	108
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)					26

2. FLOODING

FLOODING		0	1	0	3
SUBSCORE (100 x FACTOR SCORE /3)	:				0

3. GROUND WATER MIGRATION

DEPTH TO GROUND WATER	:	2	8	16	24
NET PRECIPITATION	:	0	6	0	18
SOIL PERMEABILITY	:	1	8	8	24
SUBSURFACE FLOWS	:	2	8	16	24
DIRECT ACCESS TO GROUND WATER	:	0	8	0	24
SUBTOTALS				40	114
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)					35

C. HIGHEST PATHWAY SUBSCORE

ENTER THE HIGHEST SUBSCORE VALUE FROM A, B-1, B-2 OR B-3 ABOVE.

(80)

IV. WASTE MANAGEMENT PRACTICES

A. AVERAGE THE THREE SUBSCORES FOR RECEPTORS, WASTE CHARACTERISTICS, AND PATHWAYS.

RECEPTORS	(60)
WASTE CHARACTERISTICS	(80)
PATHWAYS	(80)
TOTAL DIVIDED BY 3 = GROSS TOTAL SCORE	(73)

B. APPLY FACTOR FOR WASTE CONTAINMENT FROM WASTE MANAGEMENT PRACTICES

GROSS TOTAL SCORE x	WASTE MANAGEMENT PRACTICES FACTOR x		FINAL SCORE
(73)	(1)	=	73

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HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE POSSIBLE LOW-LEVEL RADIOACTIVE DISPOSAL AREA (SITE 2)
LOCATION IOWA AIR NATIONAL GUARD, SIOUX CITY, IOWA
DATE OF OPERATION/OCCURRENCE PRIOR TO 1969
OWNER/OPERATOR 185TH TFG
COMMENTS/DESCRIPTION
RATED BY HMTC

I. RECEPTORS

RATING FACTOR		FACTOR RATING	MULTIPLIER	FACTOR SCORE	MAXIMUM POSSIBLE SCORE
A. POPULATION WITHIN 1000 FEET OF SITE	:	0	4	0	12
B. DISTANCE TO NEAREST WELL	:	2	10	20	30
C. LAND USE/ZONING WITHIN 1 MILE RADIUS	:	3	3	9	9
D. DISTANCE TO INSTALLATION BOUNDARY	:	3	6	18	18
E. CRITICAL ENVIRONMENTS WITHIN 1 MILE RADIUS OF SITE	:	0	10	0	30
F. WATER QUALITY OF NEAREST SURFACE WATER	:	1	6	6	18
G. GROUND WATER USE OF UPPERMOST AQUIFER	:	3	9	27	27
H. POPULATION (WITHIN 3 MILES) SERVED BY					
DOWN STREAM SURFACE WATER	:	0	6	0	18
GROUND WATER	:	3	6	18	18
		SUBTOTALS		98	180

RECEPTORS SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL) 54

II. WASTE CHARACTERISTICS

A. SELECT THE FACTOR SCORE BASED ON THE ESTIMATED QUANTITY, THE DEGREE OF HAZARD, AND THE CONFIDENCE LEVEL OF THE INFORMATION.

1. WASTE QUANTITY (S=SMALL, M=MEDIUM, L=LARGE) (S)
2. CONFIDENCE LEVEL (S=SUSPECT, C=CONFIRM) (S)
3. HAZARD RATING (L=LOW, M=MEDIUM, H=HIGH) (L)

FACTOR SUBSCORE A (20)
(FROM 20 TO 100 BASED ON FACTOR SCORE MATRIX)

B. APPLY PERSISTENCE FACTOR

FACTOR SUBSCORE A x PERSISTENCE FACTOR = SUBSCORE B
(20)(1) = (20)

C. APPLY PHYSICAL STATE MULTIPLIER

SUBSCORE B x PHYSICAL STATE MULTIPLIER = WASTE CHARACTERISTICS SUBSCORE
(20)(0.5) = (10)

III. PATHWAY

RATING FACTOR		FACTOR RATING	MULTIPLIER	FACTOR SCORE	MAXIMUM POSSIBLE SCORE

A. IF THERE IS EVIDENCE OF MIGRATION OF HAZARDOUS CONTAMINANTS, ASSIGN MAXIMUM FACTOR SUBSCORE OF (100 POINTS FOR DIRECT EVIDENCE) OR (80 POINTS FOR INDIRECT EVIDENCE). IF DIRECT EVIDENCE (100) EXISTS THEN PROCEED TO C. IF NO EVIDENCE OR INDIRECT EVIDENCE (80 OR LESS) EXISTS, PROCEED TO B.
(0)

B. RATE THE MIGRATION POTENTIAL FOR 3 POTENTIAL PATHWAYS: SURFACE WATER MIGRATION, FLOODING, AND GROUND-WATER MIGRATION. SELECT THE HIGHEST RATING, AND PROCEED TO C.

1. SURFACE WATER MIGRATION

RATING FACTOR		FACTOR RATING	MULTIPLIER	FACTOR SCORE	MAXIMUM POSSIBLE SCORE
DISTANCE TO NEAREST SURFACE WATER	:	0	8	0	24
NET PRECIPITATION	:	0	6	0	18
SURFACE EROSION	:	0	8	0	24
SURFACE PERMEABILITY	:	1	6	6	18
RAINFALL INTENSITY	:	2	8	16	24
SUBTOTALS				22	108
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)					20

2. FLOODING

2. FLOODING		0	1	0	3
SUBSCORE (100 x FACTOR SCORE /3)	:				0

3. GROUND WATER MIGRATION

RATING FACTOR		FACTOR RATING	MULTIPLIER	FACTOR SCORE	MAXIMUM POSSIBLE SCORE
DEPTH TO GROUND WATER	:	2	8	16	24
NET PRECIPITATION	:	0	6	0	18
SOIL PERMEABILITY	:	2	8	16	24
SUBSURFACE FLOWS	:	2	8	16	24
DIRECT ACCESS TO GROUND WATER	:	0	8	0	24
SUBTOTALS				48	114
SUBSCORE (100 x FACTOR SCORE SUBTOTAL/MAXIMUM SCORE SUBTOTAL)					42

C. HIGHEST PATHWAY SUBSCORE

ENTER THE HIGHEST SUBSCORE VALUE FROM A, B-1, B-2 OR B-3 ABOVE.
(42)

IV. WASTE MANAGEMENT PRACTICES

A. AVERAGE THE THREE SUBSCORES FOR RECEPTORS, WASTE CHARACTERISTICS, AND PATHWAYS.

RECEPTORS	(54)
WASTE CHARACTERISTICS	(10)
PATHWAYS	(42)
TOTAL DIVIDED BY 3 = GROSS TOTAL SCORE	(36)

B. APPLY FACTOR FOR WASTE CONTAINMENT FROM WASTE MANAGEMENT PRACTICES

GROSS TOTAL SCORE x	WASTE MANAGEMENT PRACTICES FACTOR =	FINAL SCORE
(36)	(0.95)	= 34

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APPENDIX E

Underground Storge Tank Inventory

Underground Storage Tank Inventory: 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa

	TANK IDENTIFICATION NUMBER					
	A	B	C	D	E	F
Building Location	234	234	241	252	261	262
Capacity (gallons)	1,000	1,000	5,000	8,000	10,000	5,000
Contents	JP-4	MOGAS	Fuel Oil	Fuel Oil	Fuel Oil	Diesel Fuel
Year Installed	1977	1977	1953	1979	1957	1978
Material of Construction	Welded Steel	Welded Steel	Welded Steel	Welded Steel	Welded Steel	Welded Steel
Coatings A. Interior B. Exterior	A. None B. Asphalt	A. None B. Asphalt	A. None B. Asphalt	A. None B. Asphalt	A. None B. Asphalt	A. None B. Asphalt
Cathodic Protection	None	None	None	None	None	None
Piping	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Status of Tank (Year abandoned)	In Use	In Use	Not In Use (1968)	In Use	In Use	In Use

Underground Storage Tank Inventory: 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa

	TANK IDENTIFICATION NUMBER					
	G	H	I	J	K	L
Building Location	262	262	263	269	672	672
Capacity (gallons)	4,000	1,000	800	1,000	25,000	25.000
Contents	MOGAS	MOGAS	Fuel Oil	Fuel Oil	JP-4	JP-4
Year Installed	1960	1960	1971	1968	1952	1952
Material of Construction	Welded Steel	Welded Steel	Welded Steel	Welded Steel	Welded Steel	Welded Steel
Coatings A. Interior B. Exterior	A. None B. Asphalt	A. None B. Asphalt	A. None B. Asphalt	A. None B. Asphalt	A. None B. Asphalt	A. None B. Asphalt
Cathodic Protection	None	None	None	None	None	None
Piping	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Status of Tank (Year Abandoned)	In Use	In Use	In Use	In Use	In Use	In Use

Underground Storage Tank Inventory: 185th TFG, Iowa Air National Guard
Sioux Gateway Airport, Sergeant Bluff, Iowa

	TANK IDENTIFICATION NUMBER M
Building Location	672
Capacity (gallons)	25,000
Contents	JP-4
Year Installed	1952
Material of Construction	Welded Steel
Coatings A. Interior B. Exterior	A. None B. Asphalt
Cathodic Protection	None
Piping	Unknown
Status of Tank (Year Abandoned)	In Use

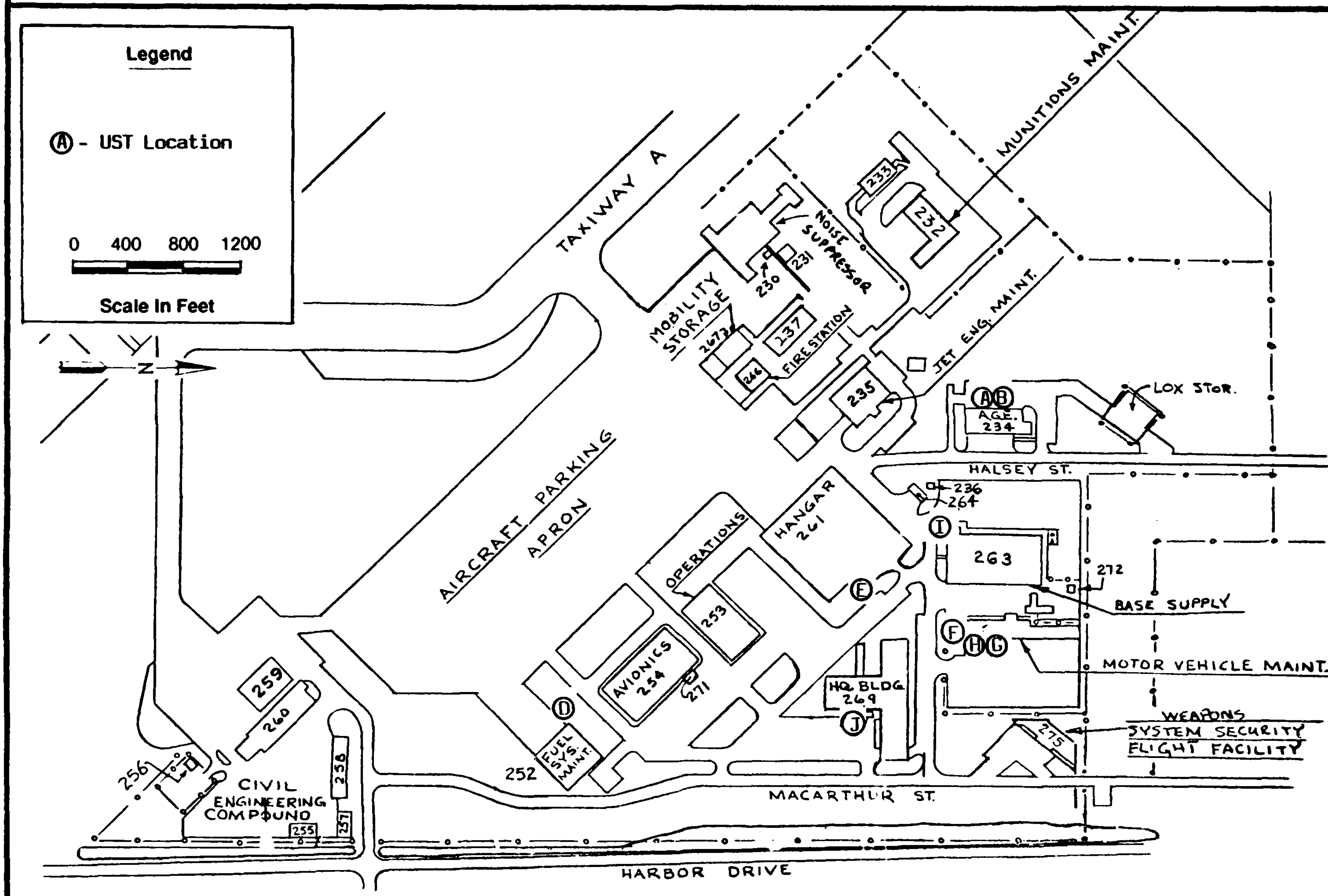
Underground Storage Tank Inventory: 133rd TCF, Iowa Air National Guard, Fort Dodge Municipal Airport, Fort Dodge, Iowa

	TANK IDENTIFICATION NUMBER A	B
Building Location	100	100
Capacity (gallons)	3,000	1,500
Contents	Diesel Fuel	MOGAS
Year Installed	1962	1971
Material of Construction	Welded Steel	Welded Steel
Coatings A. Interior B. Exterior	A. None B. Asphalt	A. None B. Asphalt
Cathodic Protection	None	None
Piping	Unknown	Unknown
Status of Tank (Year Abandoned)	In Use	In Use

HMTC

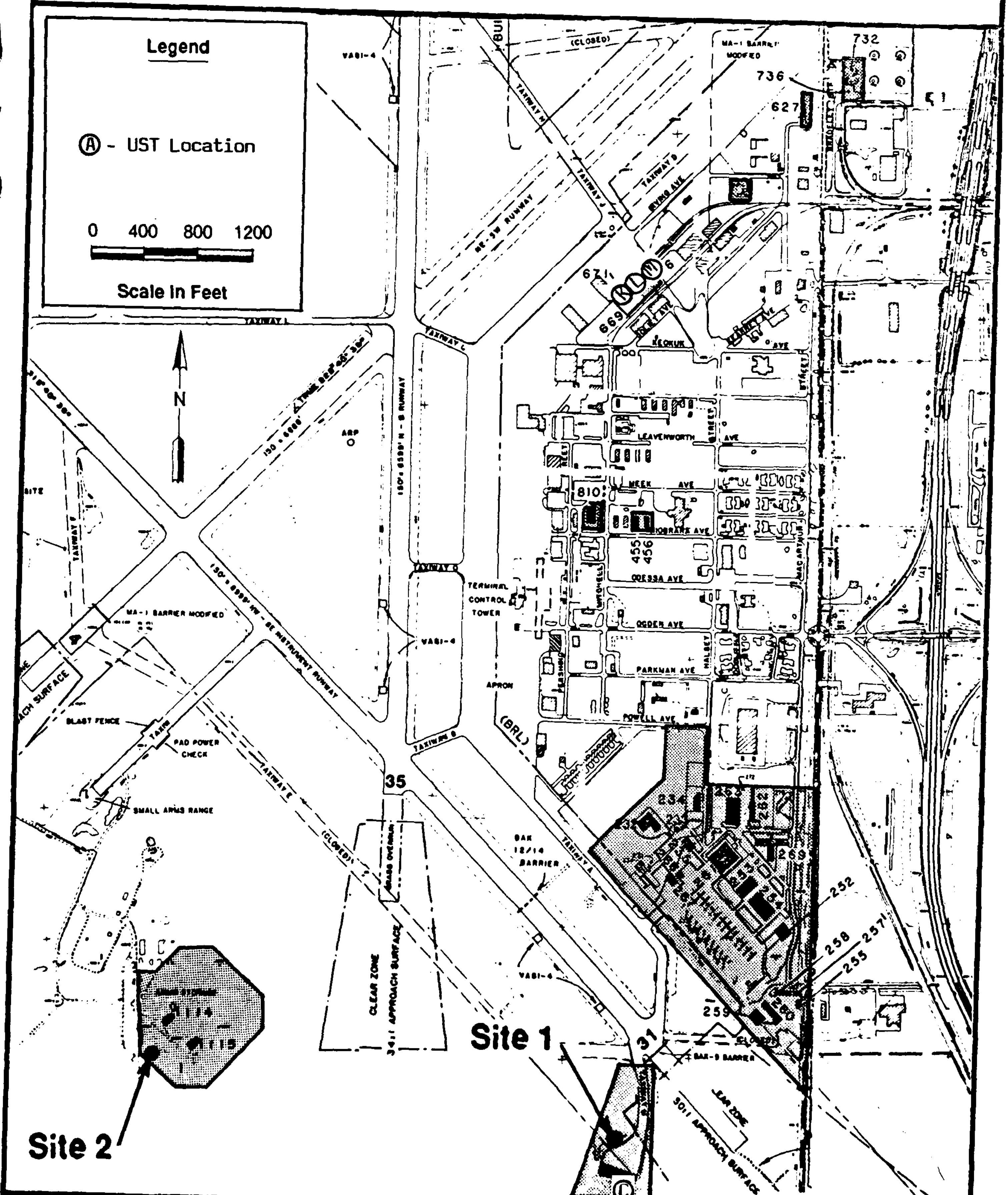
Source: 185th TFG, Area Map, 1988.

Location of Underground Storage Tanks, 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa.



HMTC Source: 185th TFG, Master Plan, 1981.

Location of Underground Storage Tanks, 185th TFG, Iowa Air National Guard, Sioux Gateway Airport, Sergeant Bluff, Iowa.



Source: Iowa Air National Guard, 1976.

Location of Underground Storage Tanks, 133rd TCF, Iowa Air National Guard, Fort Dodge Municipal Airport, Fort Dodge, Iowa.